Mariners Weather Log

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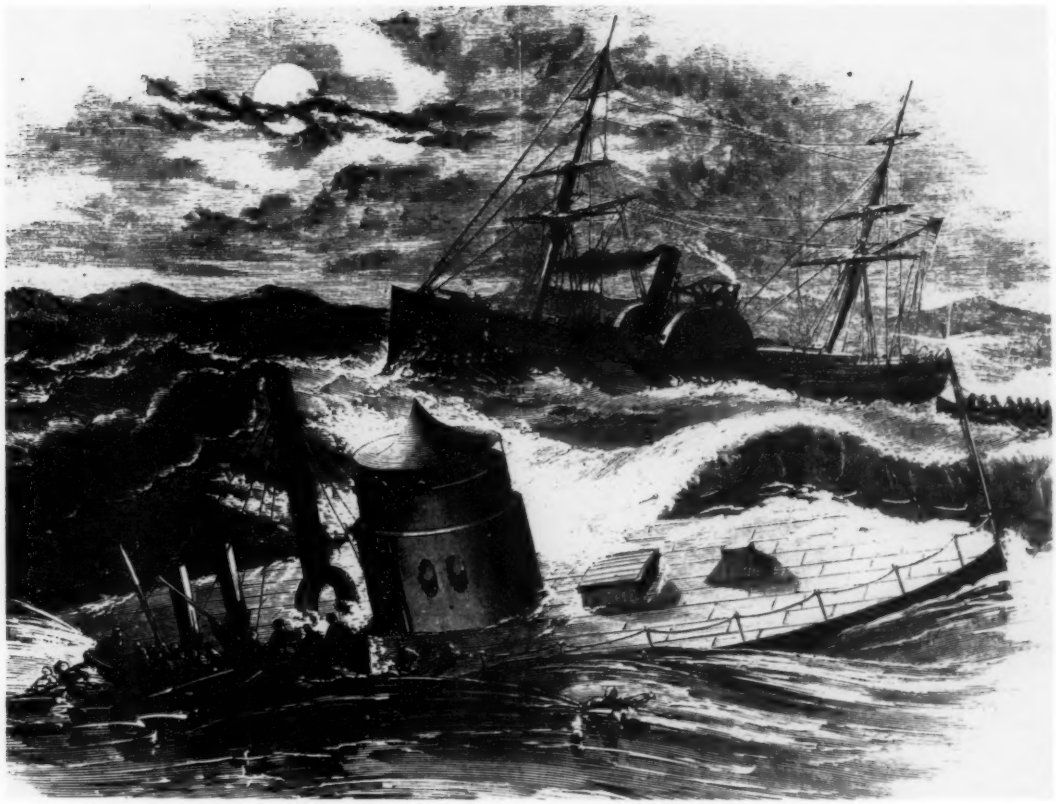

The wild New Year's Eve storm rages around the USS *Monitor* as crewmembers wait to be rescued by the side wheeler *Rhode Island* in this engraving from a January 24, 1863 issue of *Harper's Weekly*. Of the 57-member crew, 16 were lost to the waves. For more information on the *Monitor* and efforts to protect and preserve her remains, see page 4.

Mariners Weather Log

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From the Editor

Welcome back to the Mariners Weather Log! This is our long-awaited catch-up issue, which combines material from Fall 1996 and Winter 1997 and we have already begun work on the Spring 1997 issue. All paid subscriptions will be extended into next year since we were unable to complete production of all issues this year.

This issue features some long established popular columns such as Whale Oil & Wicks and the Voluntary Observing Ship Program, as well as the new columns we began last year: Tropical Prediction Center, Marine Prediction Center, Data Buoy Center, AMVER Program. There are also several feature articles, including articles on coastal currents and NOAA's National Marine Sanctuaries program. Pursuant to several readers' requests, we have returned to the more traditional magazine style format, which should improve the presentation and provide more flexibility in the layout and design of the publication.

Future issues will contain more articles from well-known specialists in the fields of marine meteorology and oceanography. For the next issue (Spring 1997), we will have an informative article about the El Niño Southern Oscillation (ENSO), which began a new cycle in 1997. We are also hoping to have an article about U.S. Air Force reconnaissance flights into hurricanes at sea.

Our apologies for the delay in getting this issue out. Hope you find it informative and enjoyable!

Martin S. Baron, Managing Editor
Mary Ann Oscanyan, Editor⚓

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Sanctuary Weather Watchers

Nancy O'Donnell
National Marine Sanctuaries

NOAA's National Marine Sanctuaries (NMS), unlike the National Park system, blend conservation of marine life and cultural artifacts with sustainable use of ocean resources. Its mission is to promote research, education, appreciation and enjoyment of each individual sanctuary's significant marine resources. While some may focus on pelagic surveys of seabirds and marine mammals or the feeding ecology of minke whales, others concentrate on intertidal research, coral diseases, or water quality monitoring. In areas where large tribal communities or where early European explorers once ventured, sanctuary archaeologists study midden sites and historic shipwrecks.

Established in 1972 by an Act of Congress, the National Marine Sanctuaries program was a federal response to growing a public concern for our vast and increasingly vulnerable marine resources. Three years earlier, an oil well explosion had spilled 3.3 million gallons of oil off the coast of Santa Barbara, destroyed marine life and the process galvanized the newly emerging national environmental movement.

Today the sanctuaries, now numbering 12, include coral reefs and giant kelp forests, humpback whale breeding grounds and brown pelican preserves in areas ranging from California to Massachusetts and places farther offshore the U.S. mainland in Hawaii and American Samoa. Two other sanctuaries are now being considered for designation: Thunder Bay in Lake Huron, Michigan, the first freshwater and Great Lakes sanctuary; and the Northwest Straits in Washington which includes the Strait of Juan de Fuca, San Juan Islands, and Northern Puget Sound. A complementary program to NMS, the National Estuarine Research Reserve System, brings together federal and state authorities to foster a system of estuary reserves that represents the wide range of coastal and estuarine habitats found in the U.S. and its territories. In pursuit of this goal, NERRS works with Federal and State authorities to establish, manage, and maintain reserves, and to provide for their long-term stewardship.

The beauty of the ocean world is commonplace to mariners—vermilion sunsets, cloud banks that rise hundreds of feet in the air, schools of gray dolphins, or wheeling seabirds escorting ships back to shore. Mariners, working in such natural splendor, can appreciate NOAA's National Marine Sanctuaries (NMS) and National Estuarine Research Reserve System (NERRS) programs work in managing and protecting marine resources of special national significance.

But it may surprise many to discover that sanctuary managers are as concerned about weather

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Sanctuary Weather Watchers

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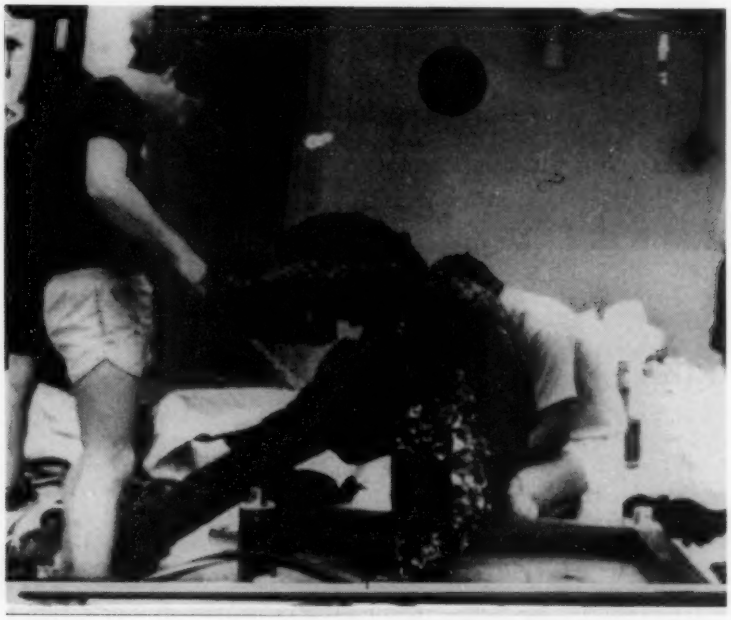
patterns, shipping routes, ocean currents, and temperatures as mariners. A sanctuary's mission—to protect threatened marine animals and their habitats and, in some areas, its work in cataloging and preserving shipwrecks or other historical artifacts that rest on the ocean floor— is often hampered by bad weather.

John Broadwater, Manager of the Monitor NMS in North Carolina, and Bill Goodwin of the Damage Assessment and Coral Reef Restoration Work at the Florida Keys NMS are two Sanctuary weather watchers who have seen their work adversely affected by a recent run of bad weather.

The Monitor National Marine Sanctuary's mission is to protect and preserve the remains of the nation's most important U.S. Civil War shipwreck. The turreted warship had a brief illustrious career in the Civil War. It is best remembered for its skirmish with the Confederate *Virginia* (formerly the USS *Merrimack*), before sinking during a violent storm off Cape Hatteras on December 31, 1862. Because the ironclad warship, USS *Monitor*, now rests upside down 230 feet below the surface and some 16 miles off Cape Hatteras, it naturally receives few visitors. Artifacts recovered from the *Monitor* site are taken to the Mariners Museum in Newport News, Virginia, for conservation and later are made available to other museums or institutions wishing to develop *Monitor* exhibits.



The *Monitor* was first discovered in 220 feet of water, 15 miles off shore Cape Hattaras by a joint expedition team from Duke University, the State of North Carolina, and MIT. The successful search took place aboard Duke University's 177-foot research vessel *Eastward*. The encrusted anchor was recovered in 1983 and now serves as a symbol for the *Monitor* Sanctuary.

For many years the location of the wreck was believed to rest in waters in the vicinity of the Cape Hatteras lighthouse. In 1973 a team headed by archaeologist Gordon Watts (North Carolina Division of Archives and History) and scientists from Duke and Delaware Universities and MIT discovered the *Monitor* 16 miles south southeast of Cape Hatteras.

Luckily, in the 20 years since its discovery, the weather has allowed researchers to reach the *Monitor* remains many times and to study the natural deterioration of the vessel. NOAA and Navy divers have also aided documenting the wreck. So far recovery efforts brought to the surface the warship's encrusted anchor and signal lantern.

Researchers, both private and government, using remote cameras and remotely operated vehicles, have puzzled over the question of whether the vessel can ever be raised.

In August 1995, the sanctuary in partnership with the Navy, attempted to stabilize the wreck to help alleviate deterioration and retrieve the ship's propeller but

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efforts were stopped by weather and ocean conditions. By fall another attempt was made, but weather once again prevented the operation. Overall, while the expedition was bombarded by bad weather, it still managed to gather new information about the condition of the wreck.

Monitor NMS Education Coordinator Dina Hill summarizes the sanctuary's weather woes: "Over the last several years weather has affected us dramatically and made it impossible to complete the mission. We've had full-fledged hurricanes, nor'easters, high waves, and poor visibility on the bottom. The heavy surface currents are so strong that tethered divers are pulled away."

Scientific expeditions to the *Monitor* site traditionally have been held between mid-May to early September, but within the last three years bad weather has closed this window of opportunity with a slam.

"Part of the problem of scheduling a dive in these waters," Hill says, "is that not enough baseline data has been collected."

Sanctuary Manager John Broadwater used graphs in a recent technical briefing package to depict the wind strength and wave height in the Cape Hatteras area and summarize weather conditions at the *Monitor* NMS site: Based on wind and wave data, the optimal work season at the *Monitor* would appear to be May through September. However, data shows that the midsummer, particularly June and July, experiences the highest incidence of thunderstorms. The Hurricane season overlaps or follows the thunderstorm season. The 1995-96 seasons alone saw a higher than normal incidence of hurricanes, severely hampering efforts to work at the sanctuary.

"The exact number, strength, and paths of hurricane cannot be predicted in advance; the same is true for the winds and seas at any given time," says Broadwater. He points to a common saying among Hatteras watermen, "July and August are the best month—if you don't get a hurricane." "Selecting the best time to work at the Sanctuary is difficult, and we must rely on statistical weather predictions," says Broadwater.

Ocean currents are another important factor impeding the *Monitor* recovery efforts and often prove more difficult than predicting wind and waves. In this area two major currents—the Gulf and the Labrador Current—converge at Diamond Shoals, jut out several miles seaward from Hatteras. From a long-range perspective, the Gulf Stream, the prevailing current, moves northeast through the Hatteras area. Its velocity at the surface can reach 4-6 knots, far too strong for diving operations. The *Monitor* lies near the western edge of the Gulf Stream where rapid fluctuations in current directions and velocity are often observed, and the wreck is sometimes washed by spiraling eddy current, adds Broadwater.

Complicating this already difficult situation are two other factors—subsurface currents and tidal currents. NOAA satellites photograph the Gulf Stream on a daily basis; however, only the surface current is recorded. No instruments between Virginia and South Carolina measure subsurface offshore currents, and similarly, no comprehensive studies have been made of the influence of tidal cycles in the Hatteras area. As a consequence, manned submersibles and divers are frequently subjected to several different currents at different depths in the water column over the *Monitor*. On several occasions divers have experienced a complete reversal of current direction, along with radical changes in temperature, turbidity, and velocity. These factors are virtually impossible to predict or even to detect before the dive begins.

Hurricanes also have plagued Sanctuary recovery plans. In 1996 alone, the North Carolina coast was buffeted and battered by hurricanes Bertha, Edouard, Fran, and Gustav.

National Weather Service Meteorologist Dan Bartholf works in the Morehead City, NC office which prepares forecasts for coast waters and offshore water out to 20 nautical miles. Bartholf agrees that Cape Hatteras is "a very potent area for storms," and he

Continued on Page 7

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lists a parade of storms—"Felix, Luis, Bertha, Fran, Albert, and Josephine."

"Certainly the hurricanes churning off the coast like Felix or Luis kick up the surf and have a decided impact on their dives," said Bartholf. "The Gulf Stream off Cape Hatteras is an area where low pressure can develop and deepen dramatically as cold air encounters the warmer waters of the Stream. This is where the Nor'easters are born."

Meteorologist Dave Swallow had first hand experience with the wild waves of the Outer Banks when he worked in the former Cape Hatteras NWS office. Swallow remembers seeing a 145-ft. beach erased in a day, noting that Cape Hatteras is located deep out on the Outer Banks, 47 miles eastward from land. "It really is more a marine based area than a land based area. The waves off Hatteras are wild all the time," said Swallow. "The cold Labrador current meets the warm Gulf

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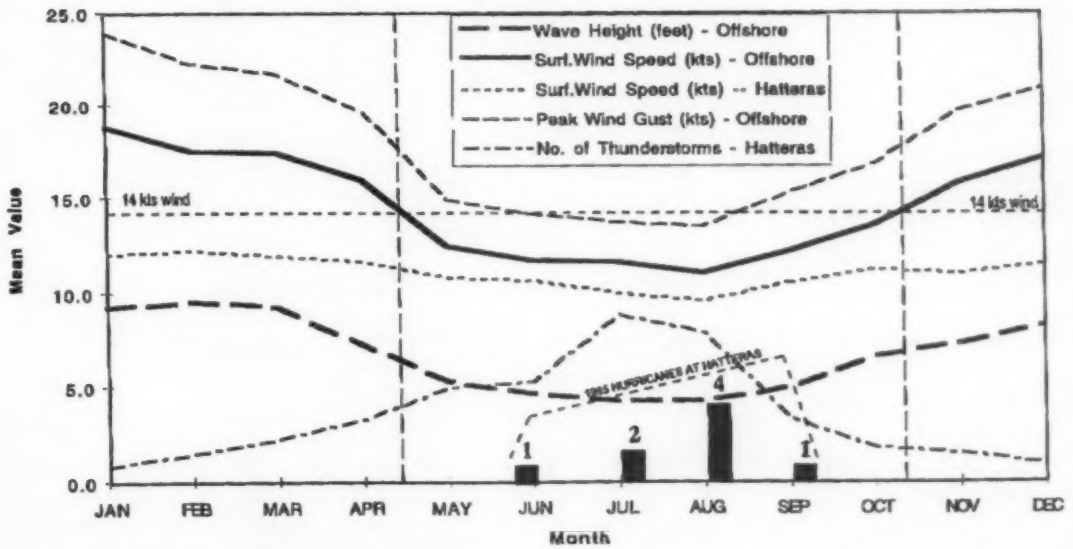
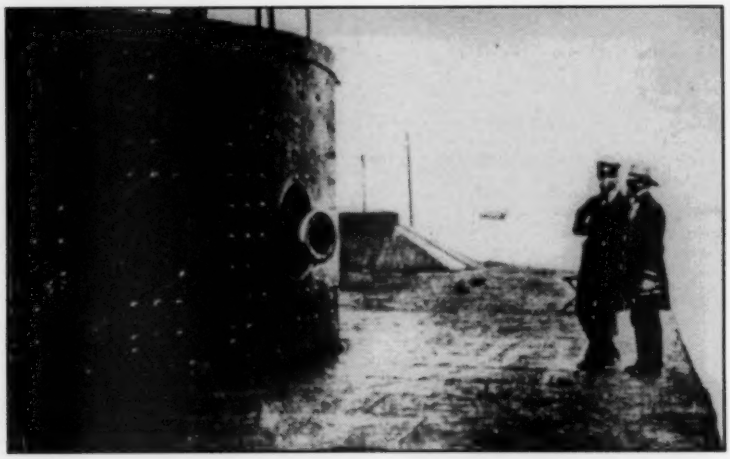
CLIMATE VARIABLE (MEANS)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Wave Height (feet) - Offshore	9.2	9.5	9.2	7.2	5.2	4.6	4.3	4.3	4.9	6.6	7.2	8.2
Surf.Wind Speed (kts) - Offshore	18.8	17.5	17.4	16.0	12.4	11.7	11.6	11.0	12.1	13.5	15.8	17.1
Surf.Wind Speed (kts) — Hatteras	12.0	12.2	11.9	11.7	10.8	10.6	10.0	9.6	10.5	11.2	11.0	11.5
No. of Thunderstorms - Hatteras	0.8	1.5	2.3	3.3	5.0	5.3	8.8	7.9	3.3	1.8	1.5	0.9
Prevailing Wind Direction - Hatteras	NNE	NNE	SW	SW	SW	SSW	SW	SW	NE	NNE	NNE	NNE

MEAN ENVIRONMENTAL CONDITIONS IN HATTERAS AREA



Mean Environmental Conditions in the Hatteras Area—"The data, supplied by the NOAA National Weather Service, were recorded at several onshore, near-shore, and offshore weather stations over the past ten years. Data are not available from all buoys over the entire ten-year period, but the graphs show clear trends in wind velocity and wave height."



Although the designer, John Ericsson, had provided for a system for forced-air ventilation, working in the *Monitor* turret would subject the sailors to temperatures reaching 140°. Another feature of the ironclad was a hidden anchor well on the centerline under the bow, where no enemy shot could reach crewmen operating the hook or chain.

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Stream which is about 4 to 5 degrees warmer and you get the interaction 3- to 5-foot waves off shore, undertow currents, thunderstorms. It's turbulent."

Sea fog can also result in this cold/warm current meeting ground, creating yet another weather nightmare for research and recovery efforts.

Farther down the coast in Florida, Natural Resource Specialist Bill Goodwin agrees on the importance of weather in the day-to-day operation of coral reef restoration and assessment at the Florida Keys National Marine Sanctuary. In addition to these daily operations, the sanctuary's Regional Marine Biologist Harold Hudson conducts long-term surveys of the coral and monitors water temperature at various parts of the reef. The sanctuary has also begun research on seabed grasses and hard bottom communities in the Florida Bay.

"I can't emphasize strongly enough how weather dictates what we're able to do," says Goodwin. "When we plan field work it's always with an eye on the weather. There were days when we intended to work in the office, but the sea is flat, it's a calm day, so we drop everything and do field work. More often is the case we plan to do field work and a surprise cold front or a heavy squall line moves in and suddenly the field work is on the back burner."

Few people recognize that coral reefs offer much more to the environment than just their beauty. Healthy coral reefs in the Florida Keys, one of the world's most biodiverse marine ecosystem, act as shoreline buffers against the impact of destructive tropical storm waves. In addition, they provide habitats for commercially important finfish and shellfish. Scuba diving, snorkeling and sport fishing, in turn, produce millions of dollars in revenue for Florida businesses.

Coral reefs are formed by the accumulation of skeletons of coral polyps, which are sea anemone-like carnivorous animals that feed at night. As they grow, coral reefs provide a thriving ecosystem for turtles, seabirds, fish, crabs, worms, and sponges. These living reefs can be destroyed by high waves in a storm and then further impacted in the storm's aftermath.

"The coral grows in spires and because of their cylindrical shape, they are prone to snapping off. We've had quite a bit of damage to the patch reef," says Goodwin. In the hurricane clean up, Sanctuary staff saved some broken branches by drilling holes in the substrate and cementing the living coral back into the reef. So far the 20 reestablished coral columns, Goodwin says, "are doing fine."

Coral not damaged by high waves can still suffer long after the storm has passed. Goodwin explains how fine sediment can stay suspended in the water for days

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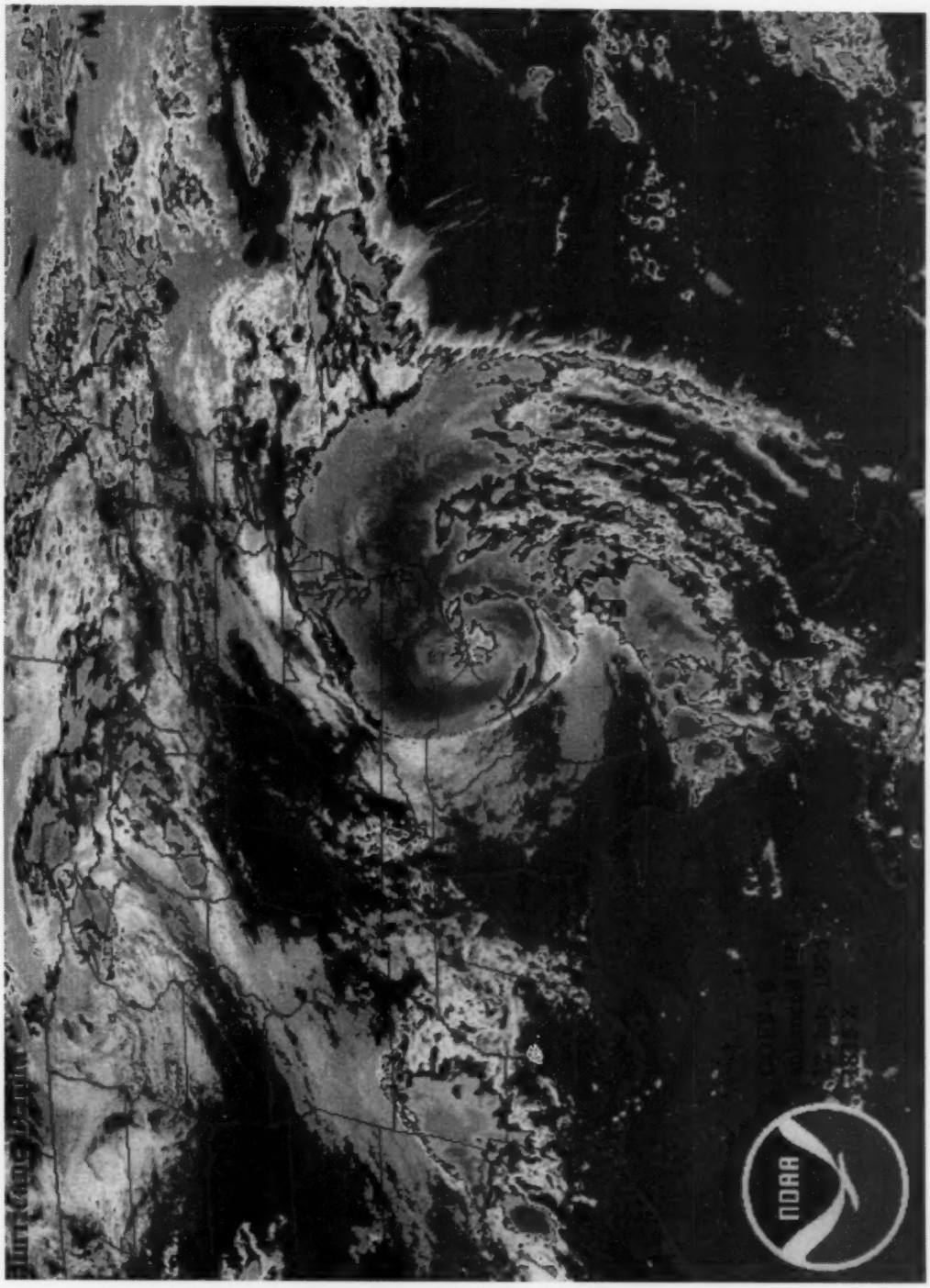

Bad news for the *Monitor* recovery team as Hurricane Bertha sweeps along the East Coast on July 12, 1996, 1815Z in this GOES-8 enhanced image.

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after a severe storm preventing sunlight reaching the micro algae or zooxanthellae within the living tissue of the corals which then provides coral with food and oxygen.

Hurricane Andrew in 1992 was especially damaging to pillar coral forests. This type is common in much of the Caribbean, yet fairly rare in Florida waters. Ships grounded during by storm wave and sea state conditions can also deal a devastating blow to vulnerable coral reefs.

Less dramatic but equally devastating to reefs is a cold weather phenomenon in Florida. If the water goes below 65 degrees for any extended period of time, inshore reefs are especially vulnerable. The reef just outside the shallow waters of Florida Bay is especially susceptible when the bay's cold water floods the patch reefs on the outgoing tides. Reefs farther offshore are less vulnerable because they benefit from the warm waters of the Gulf Stream. In one spectacular example of a cold weather event in 1969, notes Goodwin, 90% of the living coral of Hen and Chickens Reef off Plantation Key was killed.

The "One Hundred Year Storm" of March 1993 that catapulted up the eastern seaboard also led to extreme reef damage. In one case, a ship's captain intentionally grounded a ship he believed was sinking. Because the owners of the South American tramp freighter were never found, fines that could have paid for the reef restoration were never levied, and the large barren swath dug into the coral remains today.

Past storms and the marine disasters they precipitated are also important information to Sanctuary marine archaeologists; water currents and wave energy can also impact archeological rescue efforts just as it does current sanctuary research and rescue efforts.

Bruce Terrell, National Marine Sanctuary archeologist, studies historic shipping lanes and fishing grounds, personal journals, weather records, and weather patterns in his work with shipwrecks located in sanctuary waters. In his book, *Fathoming the Past: Historical Contexts of the National Marine Sanctuaries*, Terrell examines some of the recognized prehistoric and historic archaeological discoveries in ten of the U.S. marine sanctuaries and describes some of the potential resources yet to be found.

"The waters around Florida represent the greatest potential concentration of shipwrecks in the Gulf," says Terrell. "Natural hazards like barriers shoals, bars and reefs are a more typical cause of shipwrecks than open water foundering."

The Florida Keys, like California, saw the bulk of Spanish explorers who traveled to the Americas in search of treasure. The Florida Keys may well contain several thousand wrecks, including the wreck of the HMS *Looe*, 44-gun British Frigate destroyed along the reef in 1744.

Farther north the waters six miles north of Cape Cod and south of Cape Ann, Massachusetts now contain the Gerry E. Studds Stellwagen Banks National Marine Sanctuary. This sanctuary also holds a high probability for the existence of shipwrecks based on reports of historic shipping patterns and navigational hazards.

Perhaps the best known shipwreck in this section of the Atlantic was the steamer *Portland* which sank in an 1898 gale with the loss of 160 lives. The *Pentagoet*, a Civil War era coastal freighter, and several early-century fishing vessels are also known to have sunk in the region.

Weather watching has long been a part of the important every day work of the National Marine Sanctuaries whether in preservation, restoration, or protection of significant U.S. marine or coastal resources. In 1997 the National Marine Sanctuary program began a year-long celebration of its 25th anniversary. In events planned around the country, the National Marine Sanctuaries and National Estuarine Research Reserve System will be reminding Americans of our shared marine heritage and the importance of enjoying and protecting what belongs to all of us.⚓

Most Notable Storms of the Previous Quarter (October 15, 1996 to January 15, 1997)

George P. Bancroft
NCEP, Marine Prediction Center

North Pacific

The storm of October 17-18, 1996, is worth reporting on because it was the first intense Pacific storm of the season producing hurricane force winds. It deepened rapidly and developed phenomenal seas in a short period of time. Although it was not the most intense storm to form in the North Pacific during this past quarter (in terms of barometric pressure), it moved through a data rich area that has heavy shipping traffic.

The storm developed from an open frontal wave of low pressure, which is depicted on the first panel of a three panel display (Figure 1). This shows the development of the storm over a 24-hour period and the corresponding Marine Prediction Center (MPC) radiofacsimile 500 mb analysis charts broadcast to mariners via USCG Pt. Reyes, California. The charts in Figure 1 show that this development qualifies as what meteorologists refer to as a "bomb," since it intensified at least 24 millibars over a 24 hour period. It actually deepened 43 mb in the 24-hour period ending at 00Z October 18. NCEP's MPC forecasters use a "RAPIDLY INTENSIFYING" label adjacent to the track arrow connecting the low center to the 24-hour forecast position on the surface analysis to highlight such rapid development. The surface development is associated with a short wave trough depicted on the 500 mb analysis charts as rotating through a long wave trough associated with a stationary upper low center on the southern Alaska coast. This short wave was enhanced by the long wave as it became in phase, becoming more U- or V-shaped in the second panel of the figure (17/12Z) and then developed a closed 500 mb contour almost vertically stacked with the surface center on the third panel (18/00Z). The third panel of Figure 1 shows the storm center near maximum intensity and slowing near the British Columbia coast. Consult the article written by Sienkiewicz and Chesneau entitled "Mariner's Guide to the 500-millibar Chart," Winter 1995, *Mariners Weather Log*.

The attached GOES-9 infrared satellite image (Figure 2) shows the storm near maximum intensity as it was moving through Queen Charlotte Sound between the northern tip of Vancouver Island and the Queen Charlotte Islands. The colder (high) cloud tops are computer enhanced, showing that the storm attained considerable vertical development. Note that this system developed a ring of mid- to high-topped clouds around the center as depicted in the satellite image. This feature is often found in very intense extratropical lows (analogous to the eyawall of a hurricane). Cold, unstable air (denoted by small closely-spaced white or gray patches of cumulus-type clouds) wraps around the storm center to the south and east toward Vancouver Island behind the trailing cold front which was approaching the Washington and Oregon coasts. Table 1 shows data collected between 1500 UTC October 17 and 0300 UTC October 18, along and near the path of the storm. Figure 3 is a map of the

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STORM DATA (BUOYS/C-MAN)

DATE	TIME(UTC)	46005	46041	46132	46207	46004
17	1500	2033/6.1	1225/1.5			
	1600		1227/1.5	1141/4.6	1233/4.0	0423/2.4
	1700			1245/7.6	1149/9.1	0133/3.4
	1800	2531/7.0	1231/1.5	1151/10.4	2943/11.0	3639/4.0
	1900	2531/7.0	1335/2.1	1249/9.1	2945/12.5	3633/4.6
	2000	2531/7.0	1235/2.4	1152/11.0	3045/14.9	3535/4.9
	2100	2531/7.0	1237/3.0	1241/9.1	1533/13.4	3437/4.6
	2200	2629/7.6	1237/3.4	1327/9.1	1535/11.6	3435/5.5
	2300	2627/6.1	1537/4.9	1927/9.1	1637/13.4	3337/7.6
18	0000	2727/6.4	1812/6.4	2029/9.1	1539/13.1	3435/7.6
	0100	2729/6.4	1914/6.4	2235/9.1	1723/11.6	3337/7.6
	0200	2825/6.4	1819/6.1	2333/9.5	1912/10.4	3333/7.9
	0300		2014/6.1			

DATE	TIME(UTC)	46204	46147	46185	46208	46183
17	1500		0929/2.4			
	1600	1335/3.4	1031/4.0	1229/4.0	0819/2.1	0925/2.4
	1700	1241/4.6	0939/6.1	1031/4.0	0721/2.4	0621/3.0
	1800	1245/4.6	0843/7.0	0831/4.0	0629/3.0	0523/2.4
	1900		0843/9.5	0633/4.6	0625/3.4	0321/2.4
	2000	1251/6.4	0743/10.4	0729/4.6	0325/4.6	0221/2.4
	2100	1251/7.0	0745/11.6	0625/4.9	0225/6.1	0221/2.4
	2200	1252/7.6	0745/11.9	0825/5.5	0131/7.0	0517/2.4
	2300	1252/7.9	0843/12.5	0723/6.4	0131/7.9	0317/3.0
18	0000	1251/9.1	0741/11.0	0923/7.0	0129/7.9	0419/3.4
	0100	1249/8.5	0739/10.4	0921/7.6	3527/7.9	0319/3.4
	0200	1251/8.5	0633/9.1	0521/7.0	3525/6.4	0217/3.4
	0300					

SHIP REPORTS

DATE	TIME(UTC)	46184	DESW1	DUTA 48.3N 130.4W	DUTA 48.4N 128.7W
17	1500		1321		
	1600	0217/2.1	1430		
	1700	*9916/2.1			
	1800	3417/2.1	1439	2050/4.3	
	1900	3519/2.1	1345		
	2000	3519/2.1	1348		
	2100	3519/2.1	1447		
	2200	3519/2.1	1448		
	2300	3519/2.1	1440		
18	0000	3417/2.1			2241/10.1
	0100	3319/2.1	1921		
	0200	3121/2.4	1730		
	0300		1919		

DATE	TIME(UTC)	WEBR 48.8N 127.9W	WEBR 49.5N 129.6W	KGTS 51.3N 131.5W	WGEK 51.1N137.4W
17	1500				
	1600				
	1700				
	1800	1455/7.9			
	1900			1180/18.0	
	2000				
	2100				
	2200				
	2300		1448/8.5		
18	0000				
	0100				
	0200				
	0300				3440/7.9

DATE	TIME(UTC)	S6DB 51.7N 136.7W	S6DB 51.8N 139.5W	KIRH 48.6N 128.8W	KHJB 48.7N 125.7W
17	1500				
	1600				
	1700				
	1800	0142/10.4		2345/9.5	1826/5.2
	1900				
	2000				
	2100				
	2200				
	2300				
18	0000		3334/8.5		

DATE	TIME(UTC)	DZOF 52.0N 139.8W	ELKU9 47.8N 147.0W	ELRO3 47.7N 151.1W
17	1500			
	1600			
	1700			
	1800			
	1900			
	2000			
	2100	3433/5.2		
	2200			
	2300			
18	0000		2932	3026/4.9

Table 1. Listing of hourly observations of winds (knots) and significant wave height (meters) for selected buoys, ships, and the C-MAN station DESW1 for the area affected by the storm of October 17-18, 1996. The wind (first two digits of direction and two digit speed) is separated from the sea height by a slash.

*** Wind direction missing.**

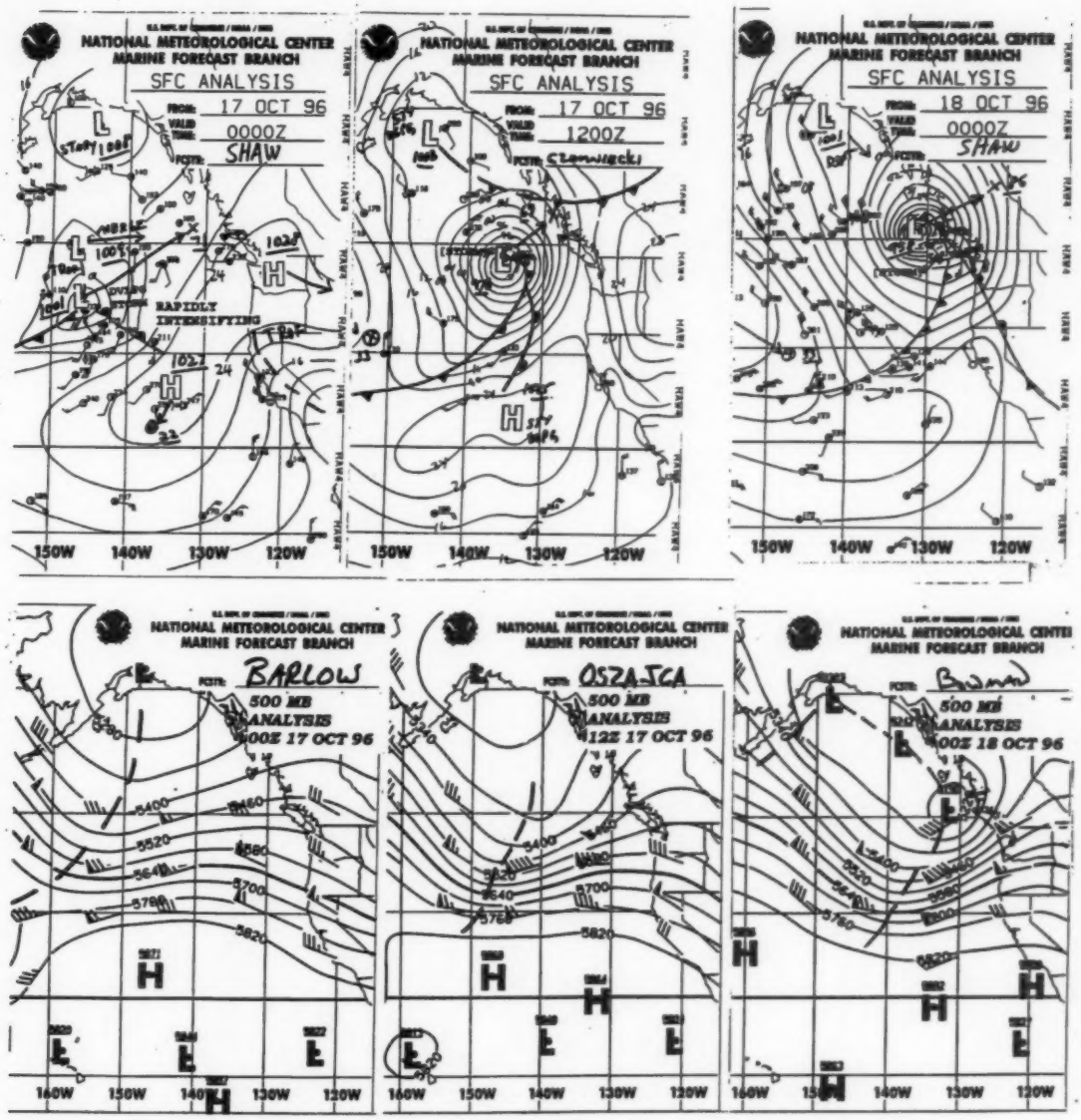

Figure 1. The three-panel diagram shows the surface pressure analyses and corresponding 500 mb analyses for the area of the North Pacific affected by the storm of October 17-18, 1996, for 00Z October 17, 12Z October 17, and 00Z October 18, 1996.

Notable Storms

Continued from Page 11

area through which the storm passed, with the track marked, and the locations of the buoys listed in Table 1 and C-MAN station DESW1 (Destruction Island, WA). An examination of the data and surface analyses shows a compact storm center that developed storm winds up to hurricane force within 180 nm of the center and ahead of the occlusion and warm front southward to the Washington coast. Just ahead of the front, the ship *Sealand Kodiak* (XGTZ) reported the highest wind and significant wave height among all the data around the storm —a southeast wind of 80 kt and seas 18 meters (59 ft) at 1900 UTC October 17. The Canadian buoys 46204 and 46207 in Queen Charlotte Sound reported peak winds exceeding 60 kt. Buoy 46204 reported an average wind of 52 kt and a peak of 66 kt shortly before the 18/00Z analysis time (Figure 1). To the south, buoy 46132, near the southwest coast of Vancouver Island, reported the same sustained wind. The seas built rapidly as the storm developed as shown in Figure 4, which compares the sea state of 17/00Z with that of 18/00Z off the west coast of North America. Note that the significant wave height at buoy 46207 jumped from 4 meters (13 ft) at 17/16Z to 9.1 meters (30 ft) only one hour later, with a maximum of 14.9 meters (49 ft) at 17/20Z—the highest reported from a buoy. Further away from the storm track, winds and seas decreased rapidly to the north and northwest. The hourly reports in Hecate Strait and ship and buoy reports west of the Queen Charlotte Islands show winds below 35 kt and seas not exceeding 8

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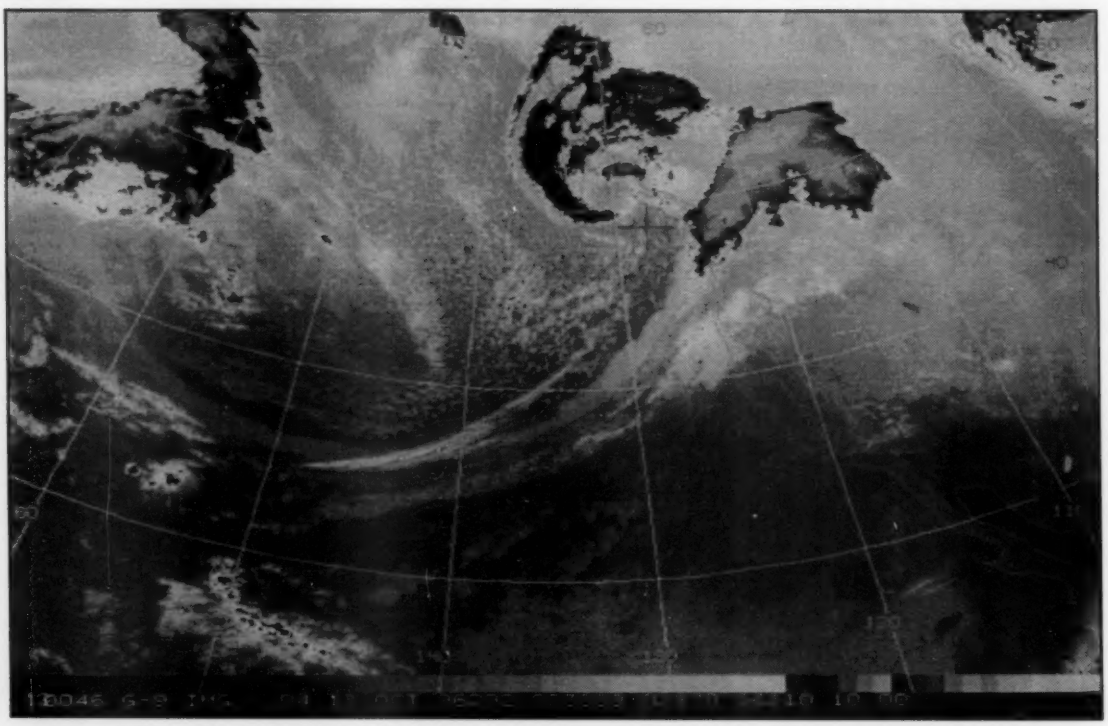

Figure 2. GOES-9 infrared satellite image showing the storm of October 17-18, 1996, at the time 0230 UTC October 18 near the time of maximum intensity. Note the "ring cloud" surrounding the center of the storm at 51N 130W.

Notable Storms

Continued from Page 14

meters. The winds and seas at buoys 46183 and 46184 (the northernmost shown in Table 1 and Figure 3) showed little response to the passage of the storm. To the south, winds reached minimal storm force at DESW1 off the Washington coast.

The storm center moved over buoy 46207 about 18/03Z shortly after the wind decreased to light southerly at 18/02Z. The storm subsequently moved to the coast at 18/06Z then weakened rapidly inland over central British Columbia, showing a 978 mb pressure at 18/12Z (a 20 millibar rise over 12 hours).

The storm of October 17-18, 1996, compares well with the storm which affected the same area on December 10, 1993, and was reported in the Spring 1994 issue of *Mariners Weather Log* (Canadian West Coast Giant Waves). That storm was of similar intensity to the one described in this article, but tracked a little to the west of the Queen Charlotte Islands and generated maximum significant wave heights similar to those of the October 17-18, 1996 storm. That article should be read in conjunction with this report since it describes rogue waves exceeding 30 meters, which can accompany these storms.

North Atlantic

The storm of November 15-17, 1996, was noteworthy because it formed off the Carolina coast and stalled south of Newfoundland in the vicinity of the Gulf Stream for a full 24 hours before beginning to drift south early on the 17th and beginning a very slow weakening trend. It did not weaken to below storm strength until early on the 19th. Although the central pressure never dropped below 990 millibars, the storm formed in a high-pressure environment, with a banana-shaped strong high pressure ridge wrapped around the west, north, and northeast sides. The strong area of high pressure, centered just north of the Great Lakes early in the storm period and over New England later in the period, broke some high pressure records for November for some locations in the northeastern and mid-Atlantic states. This resulted in a very tight pressure gradient and storm winds to hurricane force between the high pressure ridge and the occluded front which eventually wrapped around the

Continued on Page 18

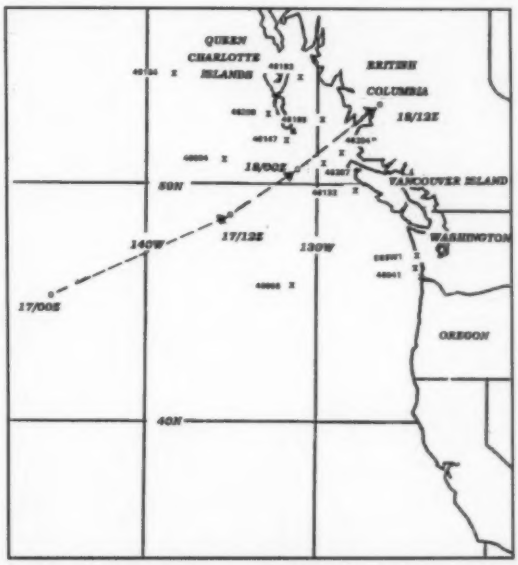

Figure 3. Map of the area affected by the storm of October 17-18, 1996, including the locations of buoys and DESW1 listed in Table 1 and the track of the storm shown as a broken line with arrows and open circles for 12 hourly locations of the low center.

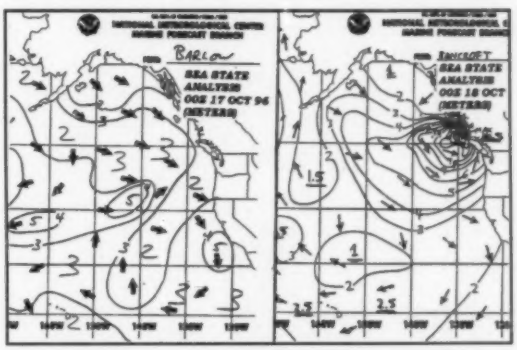

Figure 4. Two-panel diagram showing the sea state analyses for the portion of the North Pacific affected by the storm of October 17-18, 1996, at the times 17/00Z and 18/00Z. Sea height maxima and minima are shown as underlined numbers.

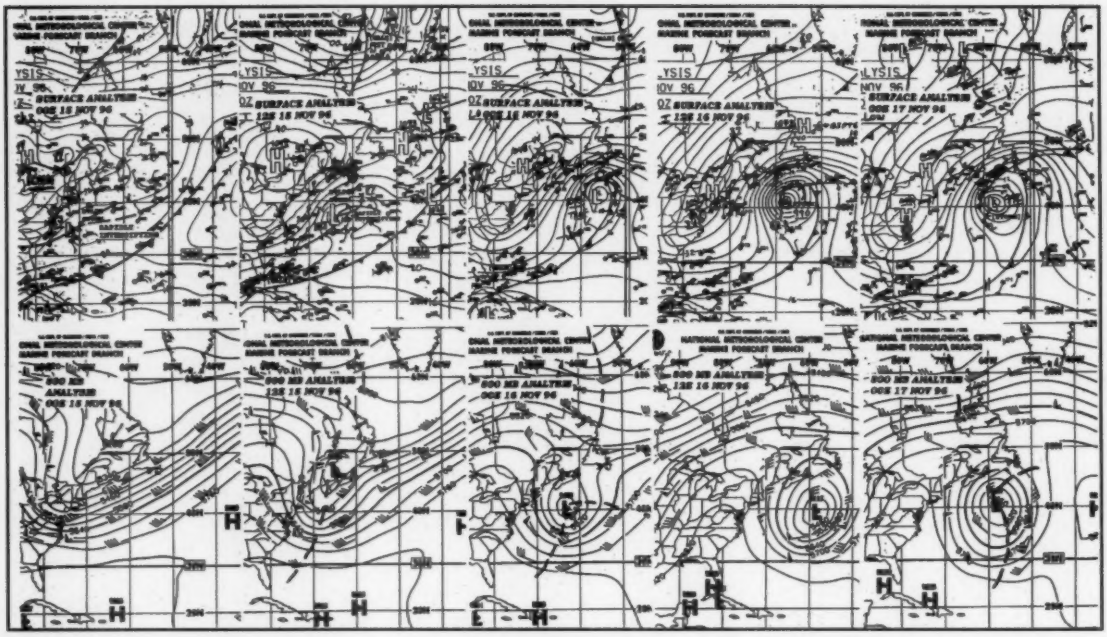

Figure 5. The five-panel diagram shows the surface pressure analyses and corresponding 500 mb analyses for the area of the North Atlantic affected by the storm of November 15-18, 1996, for 00Z and 12Z November 15, 00Z and 12Z November 16, and 00Z November 17, 1996. The charts cover the development and the most intense stages of the storm.

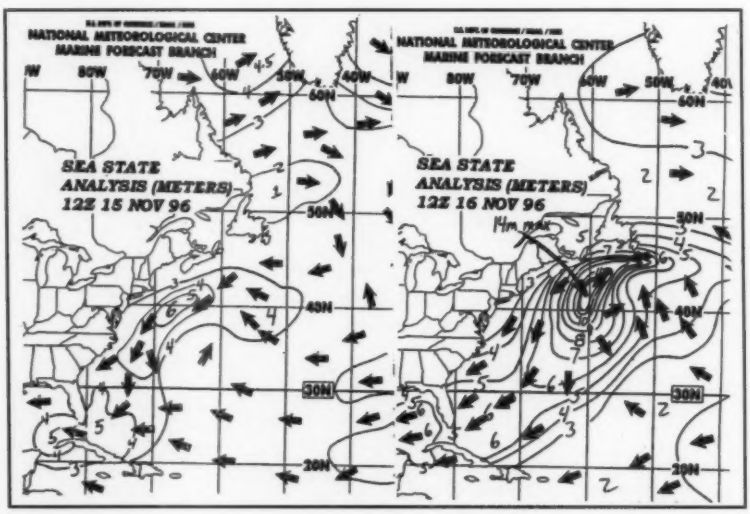

Figure 6. Two-panel diagram showing the sea state analyses for the portion of the North Atlantic affected by the storm of November 15-18, 1996, at the times 15/12Z and 16/12Z November 1996.

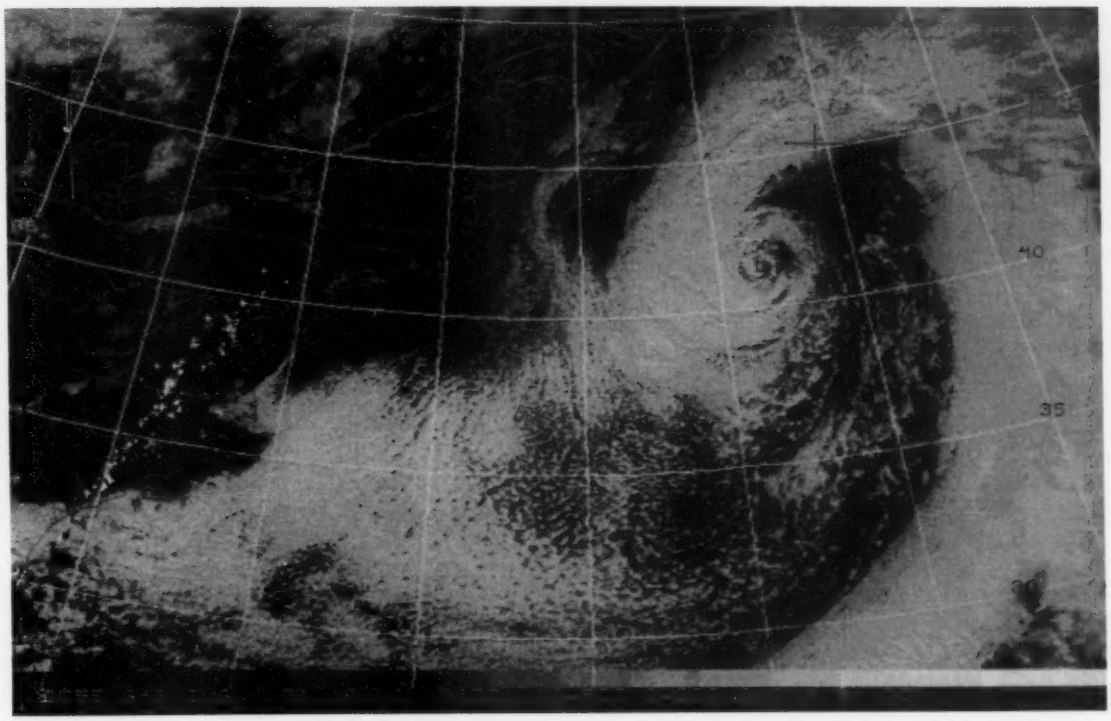

Figure 7. GOES-8 visible satellite image showing the storm of November 15-18, 1996, near the time of maximum intensity 1645 UTC November 16, 1996. Note the "ring clouds" surrounding the center of the storm near 41N 59W.

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ZCZC NFDHSFAT1 ES
TTAA30 KNFD DDHHMM

CCODE/1:31:04:11:00/AON/NWS/CCODE
HIGH SEAS FORECAST
NATIONAL WEATHER SERVICE WASHINGTON DC/TPC MIAMI FL
MARINE PREDICTION CENTER/MPB 2230 UTC NOV 16 1996
SUPERSEDED BY NEXT ISSUANCE IN 6 HOURS

FAN FAN
NORTH ATLANTIC NORTH OF 32N TO 65N AND WEST OF 35W.
SYNOPSIS VALID 1800 UTC NOV 16. FORECAST VALID 0600 UTC NOV 18.

WARNINGS

STORM 41N 58W 986 MB MOVING SSW 10 KT. WINDS 50 TO 65 KT SEAS 28
TO 46 FT WITHIN 240 NM NW AND W QUADRANTS. WINDS 35 TO 50 KT
SEAS 18 TO 30 FT WITHIN 360 NM NW AND SW SEMICIRCLES. ELSEWHERE
WINDS 25 TO 35 KT SEAS 12 TO 20 FT WITHIN 540 NM OF CENTER.
FORECAST STORM 36N 61W 985 MB. FORECAST WINDS 40 TO 55 KT SEAS
22 TO 36 FT WITHIN 240 NM NW AND W QUADRANTS. ELSEWHERE FORECAST
WINDS 25 TO 40 KT SEAS 14 TO 24 FT WITHIN 360 NM OF CENTER.

STORM WARNING. IN ASSOCIATION WITH STORM 41N 58W AREA OF N TO NW
WINDS 40 TO 70 KT SEAS 22 TO 48 FT ADJACENT TO THE NORTH WALL OF
THE GULF STREAM EXTENDING FROM 37.5N 70W TO 38.5N 65W TO 38.5N
61.5W TO 40.5N 60W. FORECAST STORM WARNING WITH AREA OF STORM
FORCE N TO NE WINDS 40 TO 60 KT SEAS 20 TO 38 FT ADJACENT TO THE
NORTH WALL BETWEEN 70W AND 61W.

IN ASSOCIATION WITH STORM 41N 58W FORECAST SECONDARY GALE 36N
51W 1004 MB. FORECAST WINDS 25 TO 35 KT SEAS 10 TO 18 FT WITHIN
360 NM E SEMICIRCLE.

SYNOPSIS AND FORECASTS

AREA OF WINDS 20 TO 30 KT SEAS 8 TO 15 FT OVER FORECAST WATERS
BETWEEN 54N AND 61N E OF 43W. FORECAST AREA TO SHIFT E OF THE
FORECAST AREA WITHIN NEXT 12 HOURS.

FORECAST LOW 58N 38W 1011 MB. FORECAST WINDS 20 TO 30 KT SEAS 7
TO 13 FT WITHIN 480 NM SW QUADRANT.

HIGH 51N 35W 1042 MB MOVING ESE 25 KT WITH A RIDGE NW TO 55N
52W. FORECAST HIGH E OF THE AREA.

PRV/MARINE FORECAST BRANCH
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Figure 8. Portion of 1630Z November 16 NFDHSFAT1 text bulletin issued by MPC near the time of maximum storm intensity. The first warning paragraph describes general gale and storm conditions associated with the storm located at 41N 58W at analysis time of the bulletin. The second paragraph describes higher wind and sea conditions associated with the North Wall of the gulf stream.

Notable Storms

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north and west sides of the storm center. There was Gulf Stream enhancement as well, although no Gulf Stream reports were received near the storm center.

The storm developed from a frontal wave on an arctic frontal boundary off the North Carolina coast with strong high pressure to the northwest just north of the Great Lakes at 00Z November 15. Rapid development was favored by movement along the Gulf Stream and a 500 mb short wave trough digging southeast out of Canada, accompanied by wind maxima which eventually, by 17/ 00Z, wrapped totally around the storm center to form a vertically stacked cutoff low. The development stage almost qualifies as a "bomb," with the most rapid 24-hour pressure drop being 23 millibars from 15/12Z to 16/12Z, just short of 24 millibars. However, the approaching strong high to the north helped boost winds rapidly up to gale force by 15/06Z and to storm force 12 hours later, around the north and west sides. The storm slowed and became stationary south of Newfoundland near 41N by 16/00Z and the pressure bottomed out at 990 mb 12 hours later. Figure 5 is a five panel display of 12-hourly surface analysis and 500 mb analysis charts covering the first 48 hours of the storm's history. Beginning on the 17th at 00Z, the vertically stacked storm began to drift south and the high surrounding the north and west sides of the storm began to weaken, along with the pressure gradients. However, it was not until 48 hours later that the storm was downgraded to a gale.

An examination of the surface analyses in Figure 5 shows numerous reports of gale to storm force winds around the north and northwest semicircles of the storm, mainly on the cold-air side of the occlusion and warm front. By 17/ 00Z storm winds extended down to 34N on the southwest side of the storm (see ship report of 50 kt near 34N 61W). The period from 16/06Z to 16/18Z appeared to be the peak of the storm for winds and seas. The Canadian platform 44144, near Sable Island, reported winds around 65 kt out of the north or northeast at every synoptic 6-hourly map time during this period. This was the highest reported wind during the 48 hour period ending at 17/00Z. Because of limited fetch, seas only reached 7 meters (23 ft) at the platform. Much higher seas were reported to the south, such as the 10 meter (33 ft) seas from Canadian buoy 44137 (41.6N 60W) at 16/06Z, which peaked at 13.5 meters (44 ft) just 6 hours later. Although this buoy was just west of the wrap-around occlusion in the area of tight gradient, average winds reported by the buoy only reached 45 kt. Moored buoys tend to underestimate winds during high wind and wave situations. Figure 6 depicts the sea state analyses for the map times 15/12Z (in the development stage of the storm) and 16/12Z (in the mature stage of the storm), showing the dramatic increase in the seas with this storm, especially in a crescent pattern around the north and west sides of the storm center.

A GOES-8 visible satellite image (Figure 7) shows the storm near peak intensity. It shows ring-like cloud features around the center located near 41N 59W, a common feature of intense storms (see the North Pacific portion of this article). A dense cloud band associated with the occlusion extends from south of the center around the west side and northeast through Newfoundland. The cold frontal clouds are near the east edge of the picture. Behind the front, cold air is pouring southeast off the land, becoming unstable and forming cumulus-type clouds especially after crossing the Gulf Stream.

The portion of the NFDHSFAT1 text bulletin north of 32N issued by the Marine Prediction Center (MPC) is attached for 2230Z November 16 (Figure 8). This was at the storm's peak. MPC forecasters issued storm warnings for hurricane force winds beginning with the 14/2230 UTC issuance and continued them through the 16/2230 UTC issuance. In addition, a North Wall warning was issued for higher conditions along the Gulf Stream beginning with the 15/1630Z issuance and continued through 18/2230Z extending beyond the area of general gale or storm conditions analyzed or forecast with this storm. This included winds as high as 70 kt and seas to 48 ft along the Gulf Stream during a portion of the two-day period of the 16th and 17th.⚓

Quality Control of Marine Observations at MPC

George P. Bancroft
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Marine Forecast Branch (MFB)

Overview

The importance of timely and accurate marine observations cannot be emphasized enough. Close attention by mariners to the collection, quality, and dissemination of their observations will enhance MPC's data quality control system. This article will portray to the mariner the close attention that the MPC pays to their observations.

Quality control (QC) of global marine observational data is performed by MPC meteorologists for six-hourly synoptic times on a computer workstation using a program called the Quality Improvement Performance System (QUIPS2). The marine data quality controlled include ship observations, automated data buoys (both moored and drifting), and C-MAN (Coastal Marine Automated Network) automated coastal platforms. Every six hours, observations taken globally are ingested by the workstation beginning about 30 minutes past the synoptic hour (0000, 0600, 1200, and 1800 UTC). Data within three hours either side of the synoptic hour are used. QUIPS2 compares observed parameters such as sea level pressure, air temperature, wind speed and direction, and sea surface temperature (SST) of each marine observation to a six-hour first guess from the NCEP operational global forecast model or (for SST) a satellite derived analysis. On average in a synoptic period, 2000 to 3000 observations are processed by QUIPS2. Of these, about 10 percent are flagged for operator review. There are three reasons for flagging: (1) at least one parameter in each observation differs substantially from the model first guess, (2) the observation is on land, and (3) it is a duplicate report.

In a QUIPS2 session, the QC meteorologist selects an area of the globe from which to examine flagged observations; then the program brings up the observations one by one on a video display screen and the operator makes a decision to keep, reject, or correct all or portions of the observation. Alternatively, if there is insufficient information on which to base a decision, the meteorologist will let the internal automated quality control of the NCEP models make the decision to keep or reject the parameter(s).

Why the Need For Manual QC of Marine Observations?

The purpose of QC is to increase the number and quality of obser-

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Quality Control

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vations that can be ingested and used by the NCEP atmospheric computer models and therefore to improve their forecast performance. The internal automated QC of the models is not good at decision-making over the oceans. Humans can do a much better job at QC than the computer. Furthermore, human intervention can correct observed data that would otherwise be lost to the models. Other data may be flagged as differing substantially from the model first guess, but a close examination of associated data sources and other nearby observations by the meteorologist may indicate the observation is good and should be kept or forced to be used by the models. Otherwise the model internal quality control might reject all or portions of the observation, throwing out the good with the bad.

Tools Used in Quality Control

The basic display of QUIPS2 shows the observation centered on a portion of the globe along with first guess model fields and neighboring reports (or "buddies") for comparison. Also available in QUIPS2 are history files of up to eight days of observations including means and standard deviations of pressure difference from the model first guess; track history (used mainly for ships); time plots of observed versus forecast parameters such as pressure, air temperature, wind speed and direction, and sea surface temperature; and editing of observations. The operator or meteorologist can consult data sources other than QUIPS2 as input to his/her QC decision, such as satellite imagery, continuity from the previous surface analysis, and existing notices of ships or platforms that are consistently sending erroneous data and/or positions.

The Quality Control Process

When the QUIPS2 program is entered for the first time in a synoptic period, a login window appears showing the number of observations, worldwide, which have been ingested so far. Another window then appears containing locations of observations plotted on a world map (Figure 1), including those flagged for operator review. A second window contains the number of new flagged observations. Using a mouse and on-screen cursor, the operator draws a box containing the observations to be examined. During the first hour of quality control this area will initially be North America and the adjacent waters of the eastern North Pacific and western North Atlantic, since, for model purposes, this is of immediate importance. The operator can then draw other boxes containing flagged observations which can be quality controlled later, after the first box has been examined.

Figures 1 through 4 are examples of types of workstation screen

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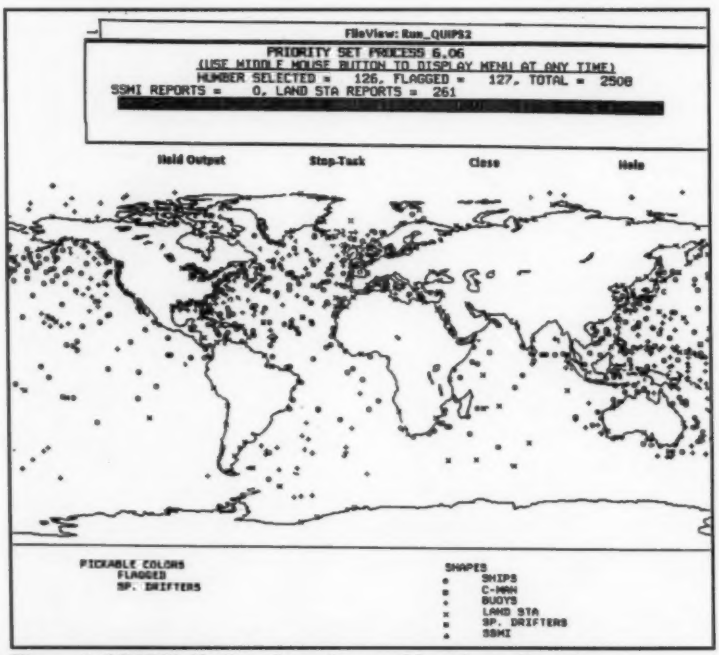

Figure 1. QUIPS2 display of numbers and locations of marine observations including those flagged for operator review. Flagged reports are enclosed in small yellow boxes in the actual display (not shown here).

Quality Control

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displays encountered while QC is being performed using QUIPS2. The basic QUIPS2 display of an observation is shown in Figure 2, which shows a portion of the globe centered on ship 3FIO6 along with other observations and an overlay of lines of equal pressure (isobars every 4 millibars) from the model first guess for comparison (in this case the 6 hour NCEP aviation or global forecast model). The smaller window in the upper left is a flag set window allowing the operator to set reject or keep flags and the upper right window is the station edit window, allowing manual correction of station data. A reject flag means that a parameter is discarded; however, if a pressure is rejected, the entire report is rejected. A keep flag forces the model to use the observation in its analysis and forecast, and is used when the meteorologist is confident that the flagged observation is good. The "DUP" flag denotes a duplicate report. In the actual QUIPS2 screen display, a flagged portion of the observation is highlighted in yellow. In the example of Figure 2, the sea level pressure of ship 3FIO6 was flagged for being 11 millibars off the model. This is supported by a "buddy" check with neighboring reports. If air or sea surface temperature were flagged, their respective model fields would have been displayed. The criteria for flagged observations are as follows, given as differences from the model first guess:

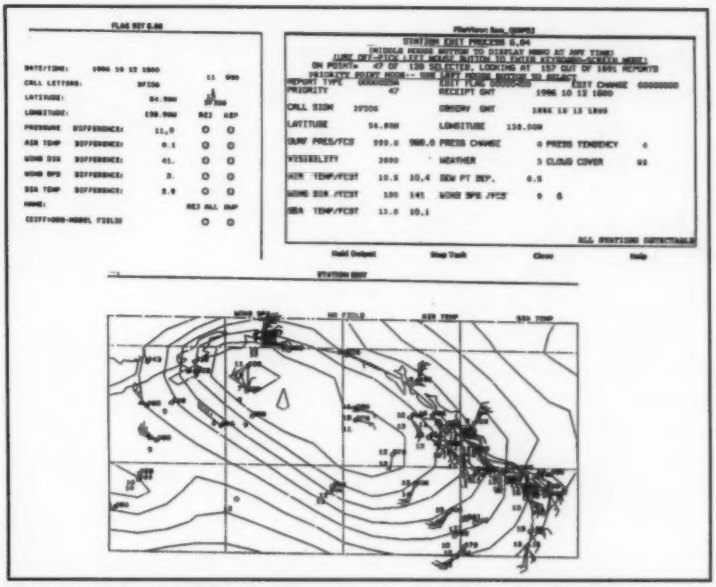

Figure 2. Basic QUIPS2 display showing a map centered on flagged observation (ship 3FIO6) with model pressure first-guess field plus station edit and flag-set windows.

Pressure	+/- 4 millibars
Air Temperature	+/- 8 deg. C
Sea Surface Temperature	+/- 6 deg. C
Wind Speed	+/- 15 knots or any wind speed greater than 47 knots (storm force)
Wind Direction	+/- 140 degrees

One can actually select any report using the workstation mouse and re-draw the display centered on the report. QUIPS2 also allows display of any observation with known callsign anywhere on the globe.

At this point the operator has several options for making a decision on a flagged report. One option is that the operator lacks sufficient information to make a decision to keep or reject and will let the model's quality control make the decision. Using a menu selection, the operator will then have QUIPS2 bring up the next flagged observation in sequence. Another option is the "time edit" menu selection which shows a history file of the ship or platform going back as much as seven days. An example of this is shown in Figure 3, a text display of the history of ship UCJV which was flagged for pressure (difference -.4 millibars from the model forecast indicated on the top line). In this case the reported pressure was consistently too low with a mean difference -6.9 and a small standard deviation of differences (a measure of consistency), leading to a decision to reject.

Sometimes a ship will show a good history except for a current report showing a large pressure error. There is also a cruise plot

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Quality Control

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function one can use which checks for position errors; however ship 3FIO6 had a track that is consistent in speed and direction. A single large error at this point likely means the observer made an error in typing the pressure (such as transposition of digits or misplaced decimal point). This can be corrected in the station edit window referred to above. This was the case with ship 3FI06 (Figure 3) which had a good history and track except an error in the current pressure. Occasionally the large pressure difference is caused by a position error which can be picked up in the cruise track plot and then corrected.

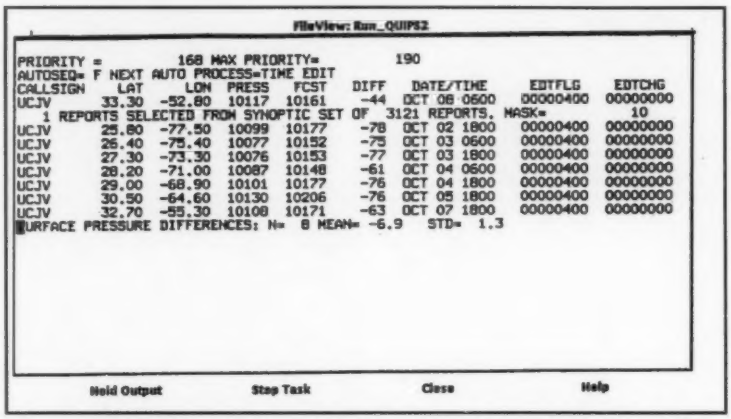

Figure 3. QUIPS2 text display of a history of an observation (ship UCJV). Up to seven days of observations are listed.

The example in Figure 4 shows the workstation screen display in track edit or cruise plot mode depicting an inconsistency in the track of a ship SLCI with an abrupt change in direction and speed (given in the upper text display of 46.1 knots during the last six hours of the track which is too high for this ship). After moving the ship 5 degrees south, a redisplay of the report in the corrected position showed that it fit in well with its surroundings. It should be noted that a ship may have several parameters flagged, leading the meteorologist to, as a first course of action, check for a position error. However, parameters are not always flagged for a ship with a position error, and the cruise plot does not always detect such an error if the vessel makes a port or other stop. Hence, it is important that mariners accurately report their latitude and longitude.

Another option in making a quality control decision is the time plot selection from a submenu. This brings up a plot of the history of the observed parameters along with the model forecasts. This, used in conjunction with "buddy checks" with neighboring observations and other aids, such as latest surface analysis, is most often helpful in evaluating flagged wind speed and/or direction, air temperature, and sea surface temperature. A decision on wind speed is made easier when a time plot shows wind speeds consistently higher than the model forecast, or close to the model forecast. A ship's wind may have a good history but the current report could be much higher than the model forecast and its neighbors, meaning a possible miscoded wind; or, depending on the synoptic weather scenario, the model's first guess could be under- or over-done.

There is a special case of a report flagged for being over land. Observed parameters in the report may or may not be flagged. When such a report is brought up by QUIPS2, the history file scrolls on the screen. This could indicate a ship that is in port. However the operator must select "station edit" to display the actual position of the report to make sure it is not in the middle of a land mass. If it is, the meteorologist attempts to correct the position using the cruise plot referred to earlier. Occasionally an automated data buoy may send in a bad position or isolated large pressure error (possible communications error) which may be corrected. Sometimes a report flagged as a duplicate is encountered. This is often a report with an incorrect callsign which is a duplicate of another

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report at the same location (with corrected callsign) or simply identical reports from the same platform at the same place and time. The meteorologist corrects the callsign and sets the duplicate flag, which means the entire report will not be used in the models.

The QC meteorologist must see to it that a report is consistent with its history and/or track and fits in well with the model and neighboring reports or otherwise makes meteorological sense before correcting a report and making a decision to keep or reject. If a report does not fit the model but otherwise looks good, it is compared to neighboring reports and other data sources such as forecasts, surface analysis, and satellite before a decision to keep is made.

As quality control proceeds, QUIPS2 keeps a running total of both selected and quality-controlled observations. Near the model run deadlines, the operator exits the program by sending the quality control decision file to a preprocessing computer in Suitland, Maryland, from which they are then sent to a Cray supercomputer in which the models are run.

The QC meteorologist provides briefings to the meteorologists in MFB who prepare the Mercator North Atlantic and North Pacific oceanic analyses on which they base their warnings and forecasts.

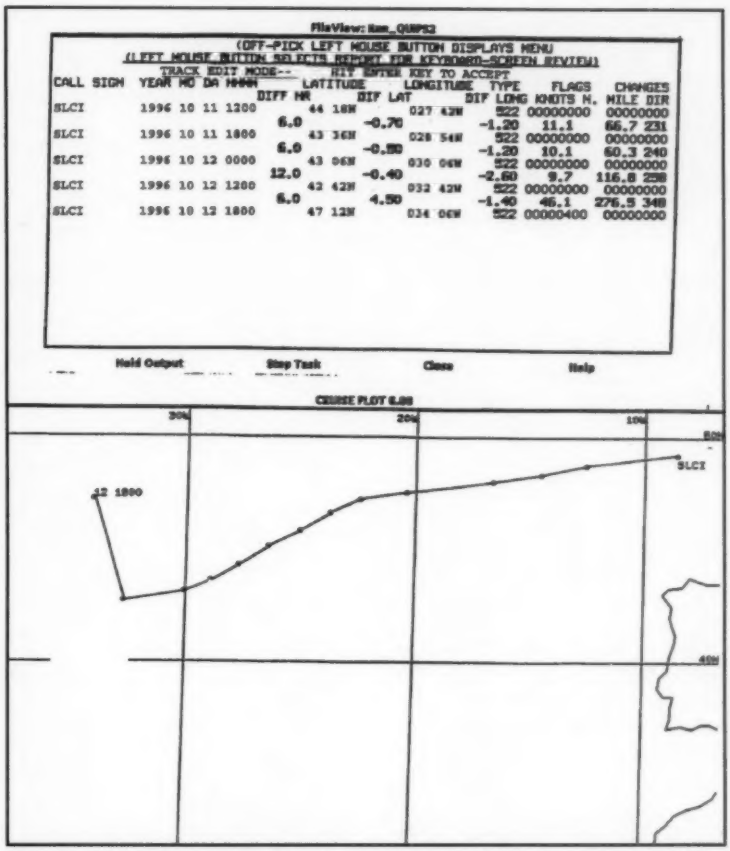
FileView: Ram_QUIPS2
(OFF-PICK LEFT MOUSE BUTTON DISPLAYS MENU
(LEFT MOUSE BUTTON SELECTS REPORT FOR KEYBOARD-SCREEN REVIEW)
TRACK EDIT MODE-- HIT ENTER KEY TO ACCEPT
CALL SIGN YEAR MO DA HHMM LATITUDE LONGITUDE TYPE FLAGS CHANGES
DIFF HR DIF LAT DIF LONG KNOTS N. MILE DIR
SLCI 1996 10 11 1200 44 18N 027 42W 522 00000000 00000000
6.0 -0.70 -1.20 11.1 65.7 231
SLCI 1996 10 11 1800 43 36N 028 54W 522 00000000 00000000
6.0 -0.80 -1.20 10.1 60.3 240
SLCI 1996 10 12 0000 43 06N 030 06W 522 00000000 00000000
12.0 -0.40 -2.60 9.7 116.8 258
SLCI 1996 10 12 1200 42 42N 032 42W 522 00000000 00000000
6.0 4.50 -1.40 46.1 276.5 348
SLCI 1996 10 12 1800 47 12N 024 06W 522 00000400 00000000
Hold Output
Step Task
Close
Help
CRUISE PLOT 6.00
30W
20W
10W
SLCI
12 1800
40W

Figure 4. QUIPS2 screen display in cruise-plot mode showing track history of a ship (SLCI).

Of course, these oceanic Mercator charts also go out to the mariner via radiofacsimile and reflect only ship observations. Most of these observations are not QC'd in time for the scheduled broadcast deadline. Incorrect observations stand out in the hope that the ship will make corrections in time for the next synoptic analysis chart.

Summary

This article points out the importance placed by the MPC marine meteorologists on marine observations taken by ships and automated platforms. After all, the ultimate aim is to improve the models that are used as guidance by the marine forecasters. If the observation data base is good, the initial analysis from which a model forecast is run will be good. Initialization is critical to the forecast process, and begins with timely and accurate observations.⚓

Coastal Currents

Bruce Parker
National Ocean Service

In the last Physical Oceanography column we looked at the various causes of changes in water level. In addition to this vertical (up-and-down) motion of the water's surface there is also horizontal movement of the water, referred to as *currents* or *circulation*. Currents, along with the wind, can have a significant effect on a transiting ship. The strongest currents that a ship will encounter are usually in a bay or port, often at the entrance. Especially for large ships, knowledge of current direction and speed (*set* and *drift*) are important for accurate maneuvering of the ship, particularly turning and docking. When one channel meets another at a right angle, a cargo ship may not be able to make the turn except at times when the currents are below some critical value. When two

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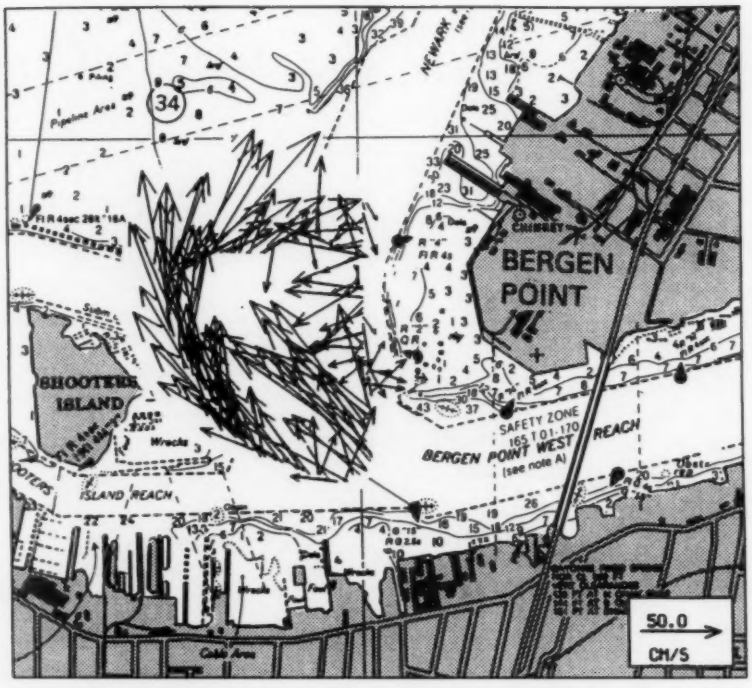

Figure 1. The spatial variation in current vectors from one tow of a downward-looking acoustic doppler current profiler (ADCP) near Bergen Point in the Port of New York and New Jersey.

Coastal Currents

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ships pass each other in a narrow waterway, right of way is usually given to the ship moving with the current ("the fair tide") because that ship will have less maneuverability. Thus, accurate information about currents can help prevent collisions and groundings.

If there should be an accident and a hazardous spill results, knowledge of the currents is important for predicting the movement of the spill so that it can be efficiently cleaned up. Information about the currents is used for search and rescue operations in helping to determine where a life raft might have drifted. Beyond their importance in navigation, currents also play a crucial role in most chemical, geological, and biological processes in the coastal ocean. It is the currents, for example, that flush pollutants out of a bay, that stir up and transport sediments (perhaps slowly filling up a navigation channel), and that move fish, crab, and oyster larvae between bays and the ocean.

What causes these currents? The phenomena represented in the cartoon in the last Physical Oceanography column (i.e. phenomena that produce changes in water level) also produce currents along the coast and in bays and estuaries (we'll save discussion of ocean currents, like the Gulf Stream, for a separate column). These include the astronomical tide, winds, river flow, and variations in salinity and temperature. It is easy to see the connection between water level changes and currents, especially in a small bay, where as the water level rises there must be flow (currents) into the bay as it fills with water, and vice versa. But the

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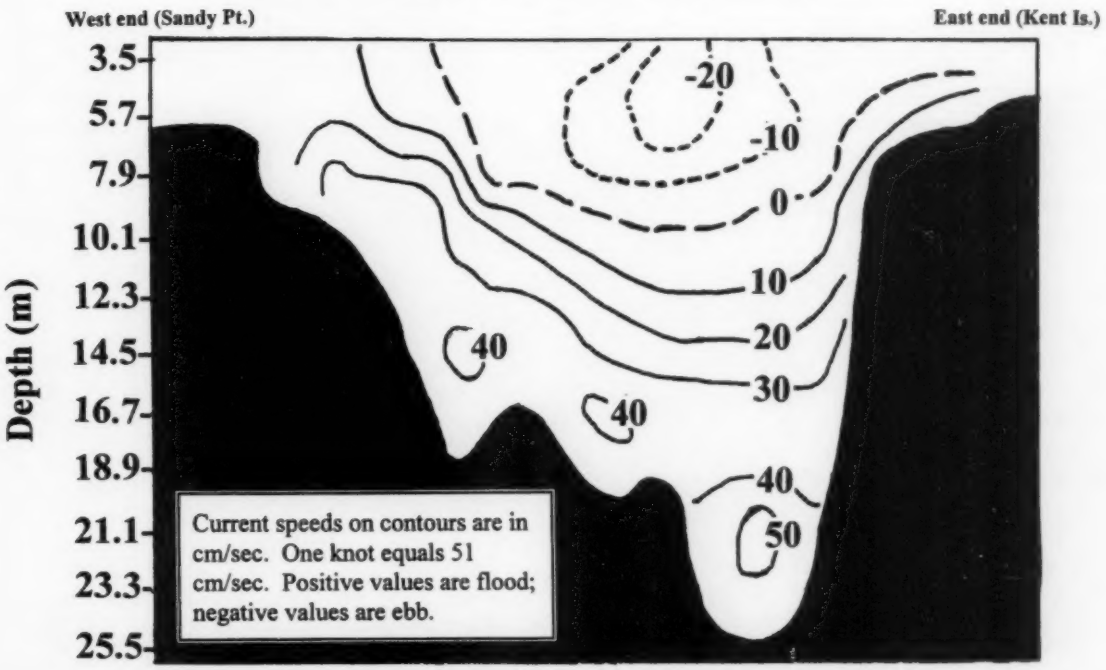
Figure 2. Current flow through a cross section near the Chesapeake Bay Bridge.



Coastal Currents

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magnitude of the water level change may not correlate with the magnitude of the current flow. For example, there may be a large drop in water level due to an offshore wind, but if it happens over two days, that means that the water will empty out slowly and the associated currents will have low speeds. Tidal currents are usually the largest currents; in this case the water flows out of the bay in only 6.21 hours (half a semidiurnal tidal cycle). Also, maximum current speeds may not occur at the same locations as the maximum water level changes, nor at the same times. For example, the greatest water level variation is often at the head of the bay, but the currents there will be approximately zero (since the shore prevents the water from moving horizontally); the largest currents will be occur at the bay entrance. Near the head of a bay the time of maximum flow will occur approximately half way between the time of high water and the time of low water. At the time of high water, the current will be approximately zero, because the water level has reached its peak and is starting to go down.

Currents and changes in water level may be horizontal and vertical manifestations of the same phenomenon, but the currents are more complicated than the water level change. For one thing, water level change is a *scalar* quantity having only one variable (like temperature it simply goes up and down). A current is a *vector* quantity, having both a speed and a direction (the combination being referred to as *velocity*). The vector arrow representing the current at a particular location changes in both size (speed) and in direction. Water level varies spatially only in two dimensions, i.e. with geographic location. Currents vary spatially in three directions, with location (like the tide), but also with depth. Currents are slower near the bottom due to the frictional effect of the bottom on the flow. Also, due to a variety of other hydrodynamic effects, currents are also much more variable (than water level) with changing horizontal position. (Figure 1 illustrates a typical variation in currents over a small area.) For example, currents are usually faster in a navigation channel than in the shallow waters on both sides, although the water level will not be appreciably different. Near the time of *slack water*, when the tidal current is changing from *flood* (flowing into and up the bay) to *ebb* (flowing out of and down the bay), or from ebb to flood, there may be only one point in the water column where the current speed is actually zero (see Figure 2). Below that point the current could be flowing into the bay, and above that point flowing out of the bay. Where the currents become even more complex are near channel bends and on both sides of a point. In the latter case *eddies* form behind the back (sheltered) side of the point (relative to the direction of the flow in the main channel).

Tidal currents are merely the horizontal flows that accompany the changing astronomical tide. In a narrow waterway such currents are bidirectional, either flowing into the bay (flood) or out of the bay (ebb). These are referred to as *reversing* tidal currents. A graphical representation of the current speed, with the flood direction being positive and the ebb direction negative, will look just like a tide curve (for example, like the Baltimore tide curve from the last Physical Oceanography column). However, off the coast and in the middle of wide bays one sees *rotary* tidal currents, where the direction of flow rotates around the compass in one tidal cycle. This rotation is due to the Coriolis force (see the last Physical Oceanography column) and is usually clockwise in the Northern hemisphere, although in bays local geographic effects can cause opposite rotations. With a rotating tidal current there is no true slack water (time of no flow), only a time with minimum flow, usually in a direction perpendicular to the two predominant flow directions (at maximum flood and at maximum ebb) along the alignment of the channel and bay. Thus, if we portray the current flow at one location on a chart, with current vectors that change in length and direction over the tidal cycle, the tips of the vector arrowhead will trace out an elliptical shape (see Figure 3). The narrower the waterway the narrower the ellipse will be, until, for a very narrow channel, we reach the bidirectional (reversing) situation. When

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Coastal Currents

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a waterway narrows the current speeds tend to get larger, because the same amount of water must flow through that smaller cross section in the same amount of time as through the larger cross section (so the ellipses get longer as well as narrower). Tidal current speeds are typically on the order of 1 to 3 knots, but can reach 8 knots or more. The latter situation usually occurs in straits with dramatically different tides at each end, the resulting currents being referred to as *hydraulic currents*.

Like the tide, tidal currents are predictable using special statistical techniques (*harmonic analysis*) that take advantage of their periodic nature and the fact that the energy will be at known astronomical frequencies determined by the movement of the earth, moon, and sun. It gets a little more complicated because tidal currents are vectors and have not only speed but direction, but this can easily be handled mathematically. More of a problem is the variability in the tidal currents caused by various phenomena that do not have similar effects on the tide. For example, when the water density varies with depth, with fresher (lighter) water near the surface and saltier (heavier) water near the bottom, an *internal wave* at tidal frequencies can occur. This can be thought of as a wave moving along the interface between two layers of water of different density (in a similar manner to a wave moving along the interface between the water and the air, but with larger amplitude). The speed and timing of the tidal current can be affected during such conditions. Internal waves at tidal frequencies can also occur offshore, when there is a density increase with depth corresponding to a decrease in water temperature, with warmer (lighter) water near the surface and cooler (heavier) water deeper.

Although strong currents may not be associated with wind-caused changes in water level (unless the changes occur quickly in time), the wind is a major cause of currents by its direct frictional action on the surface of the water. Every situation is different, but an average of several years of current data from twenty lightships off the East Coast of the U.S. showed currents on the order of 0.6 to 1.0 knots for winds on the order of 50 miles per hour. Although wind speeds are usually greater during the winter months, the water temperature stratification (i.e. layers of water with different temperature and density) found in coastal waters during the summer confines wind-produced currents to above the thermocline (a layer of rapid change in temperature and density), leading to larger currents for the same strength wind.

With respect to the mechanism by which the wind produces a current, we can think of the wind as rubbing on the water's surface and dragging it forward. The surface layer then drags the water layer below it along (through internal friction), and so on, with each layer below moving at a slower speed. Thus, such *wind currents* or *wind drift* have the largest speeds near the surface and decrease with depth, although there can be significant return flows along the bottom when the surface current flows toward a shoreline. However, our picture of the transfer of momentum from the wind to the currents in the surface layer of the water is complicated by the fact that the wind also generates waves. The waves themselves, although an oscillating phenomenon with orbital motions, cause a net drift of water particles and so contribute to the current. Even more

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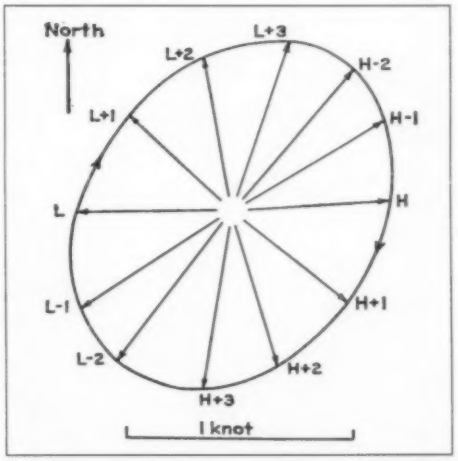

Figure 3. A rotary tidal current at Nantucket Shoals Lightship. [Times are hours after High Water (H) or Low Water (L) at Boston.]

Coastal Currents

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important in terms of the transfer of the wind's momentum to the current is wave breaking. Oceanographers can, however, ignore these details and still manage to represent and predict wind-produced currents quite accurately using hydrodynamic models that employ only a simple wind stress term.

Near the shore, particularly in and near the breaker zone, waves cause the generation of *longshore currents* and *rip currents*. The breaking waves transport a considerable amount of water toward a beach, which must return to the ocean in the form of rip currents, usually found at locations along the beach where the waves are smaller; for example, over areas where the water is deeper. If the waves approach the beach at an angle, their momentum after breaking produces longshore currents. These currents transport sand (after it has been stirred up by the waves) along a beach, often leading to significant beach erosion.

In the upper end of an estuary the river will make a major contribution to the currents. Such river flow is merely fresh water running down hill being slowed by the frictional effect of the river bottom. When tidal currents are present the flood currents will work against the river flow leading to slower combined currents; the ebb currents will work with the river flow leading to faster combined currents. As one moves further down the river, it usually widens, leading to a decrease in the speed of the river current. In this case the tidal current maximum speeds are probably larger than the river current speed, and so the river current will merely increase the ebb current speed and decrease the flood current speed. As the fresh river water meets the salt water from the ocean, the situation becomes more complicated. The tidal currents will mix these two water masses, often so much that the density is the same from top to bottom. However, there is a significant density gradient going up the estuary, from the most saline water at the ocean entrance to fresh water in the river. Gravitational effects on these differing water masses will produce a mean flow out of the estuary near the surface, but up the estuary (toward the river) near the bottom. This can be thought of as the lighter fresher upstream water falling over on top of the heavier saltier downstream water, the latter pushing up the estuary under the lighter water. This is usually referred to as *estuarine* or *gravitation circulation*.

All these mechanisms for producing or contributing to currents have different time scales. Tidal currents, of course, have a basic semidiurnal (12.42-hour) period, although in many locations there can be a significant (and sometimes dominant) diurnal period (24.84-hour) oscillation (which can be further enhanced by currents caused by land breeze-sea breeze effects). There can also be significant higher-frequency oscillations, especially in the quarter-diurnal frequency band (6.21-hour period) caused by shallow-water effects or by the eddies found near points and channel bends (mentioned above) or by asymmetries in flow caused by varying bathymetry or geography. Wind-caused currents can have time scales from hours to days to even months (if there are significant seasonal effects on wind direction and speed). River flow varies significantly with rainfall (and snowmelt) on a daily, weekly, or seasonal time scale. Constant wind blowing in one direction for a long period of time, or river flow, will appear to be a mean flow, at least with respect to the relatively rapidly changing tidal currents. So called "mean" flows also result when current data is averaged over some time period for a location where the geography produces an asymmetry in the flow. For example, if currents are measured at a location in an eddy generated by an ebb tidal current on the sheltered side of point (that eddy will not occur during the flood phase), then the data averaged over a tidal cycle will show a mean flow. Mean or long-term current flows have an important effect on the transport of pollutants and sediments. Like water level, currents are produced by a varying combination of all these effects, and accurate prediction depends on sophisticated numerical models and real-time data from a variety of sensors.

Tropical Prediction Center Report

July through September 1996

Dr. Jack Beven
Tropical Prediction Center
Tropical Analysis and Forecast Branch

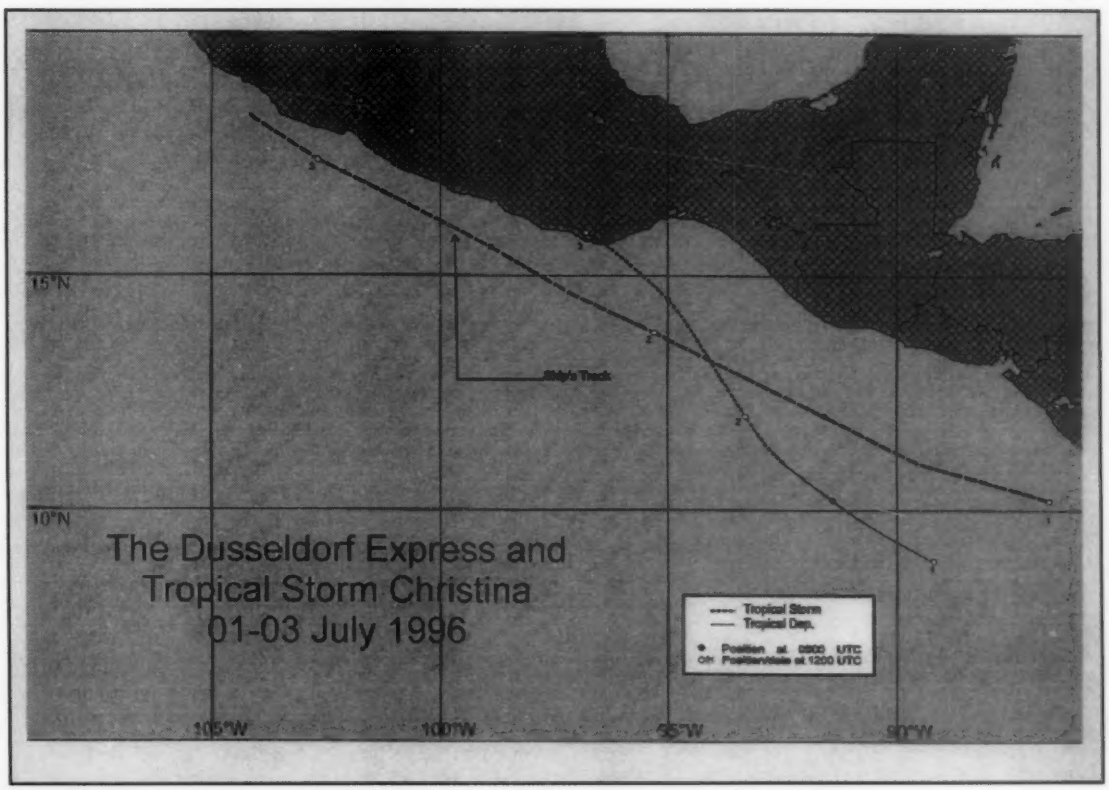

Figure 1. Tracks of Tropical Storm Cristina and the *Dusseldorf Express*, 1-3 July 1996.

I. Introduction

July through September marks the peak of the hurricane season in both the Atlantic Ocean and Eastern Pacific Ocean. This year was no exception: fifteen tropical cyclones developed in these areas during this time. The quarter also included a volcanic eruption that kept Tropical Prediction Center (TPC) aviation forecasters busy. There was also an interesting ship encounter with a tropical cyclone.

II. The Value of Frequent Weather Reports

TPC saw an excellent example of the value of frequent ship reports near tropical cyclones, when in July the ship *Dusseldorf Express* had an encounter with developing Tropical Storm Cristina.

The *Dusseldorf Express* is a cargo or container ship owned by a German company and registered out of Newark, New Jersey, USA. An interesting feature of this vessel is that it carries an automated weather station that transmits observations every hour. Ships normally transmit observations three or six hourly. This extra observing capability makes the *Dusseldorf Express* (and its sister ships) invaluable as a mobile observing platform during significant weather events.

The *Dusseldorf Express* was sailing west-northwest off the west coast of Central America when it met Tropical Depression Five-E on 1 July (Figure 1). Table 1 shows the most pertinent 24 hr of observations from the encounter.

Tropical Depression Five-E was upgraded to Tropical Storm Cristina based on the 34 kt winds reported at 2200 and 2300 UTC 1 July. This brings up an important point. The normal three-hourly observations (taken at 01/1800 UTC, 01/2100 UTC, and 02/0000 UTC) would not have reported winds of more than 30 kt. Thus, the National Hurricane Center (NHC) never would have known about the tropical-storm force winds. Since satellite intensity estimates were still below tropical storm force, the cyclone would not have been upgraded to a tropical storm at this time.

Tropical cyclones can be quite concentrated, and ships passing through a cyclone core may not experience extreme conditions for more than an hour or two. Thus, three-hourly ship reports requested by NHC may not always show extreme conditions. It would be a good idea for mariners to transmit special hourly observations when their ships are experiencing tropical storm or hurricane conditions. If this isn't possible, it would be a good idea to include plain language remarks on three- or six-hourly reports giving extremes of wind and pressure observed since the last transmitted

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Table 1. Observations of the *Dusseldorf Express*, 1200 UTC 1 July 1996 - 1200 UTC 2 July 1996.

Date/Time (UTC)	Lat. ° N	Lon. ° W	Wind Dir/Speed (kt)	Pres. (mb)
01/1200	10.2	87.6	080/26	1009.8
01/1300	10.3	88.0	080/11	1011.0
01/1400	10.4	88.3	080/16	1011.3
01/1500	10.5	88.6	080/23	1011.2
01/1600	10.7	89.0	090/23	1011.2
01/1700	10.8	89.3	110/28	1011.2
01/1800	11.0	89.6	100/24	1010.7
01/1900	11.2	90.0	090/27	1010.0
01/2000	11.3	90.3	090/30	1009.3
01/2100	11.5	90.6	080/30	1008.5
01/2200	11.6	91.0	070/34	1007.3
01/2300	11.8	91.3	070/34	1006.8
02/0000	12.0	91.6	080/29	1007.4
02/0100	12.1	91.9	070/30	1007.8
02/0200	12.3	92.2	060/29	1008.6
02/0300	12.4	92.6	060/26	1009.3
02/0400	12.6	92.9	030/22	1009.9
02/0500	12.8	93.2	330/20	1010.8
02/0600	12.9	93.5	340/19	1010.8
02/0700	13.1	93.8	030/08	1011.1
02/0800	13.2	94.1	200/08	1011.1
02/0900	13.4	94.4	270/08	1011.1
02/1000	13.6	94.7	090/12	1009.4
02/1100	13.7	95.0	020/21	1009.7
02/1200	13.8	95.3	040/10	1010.6

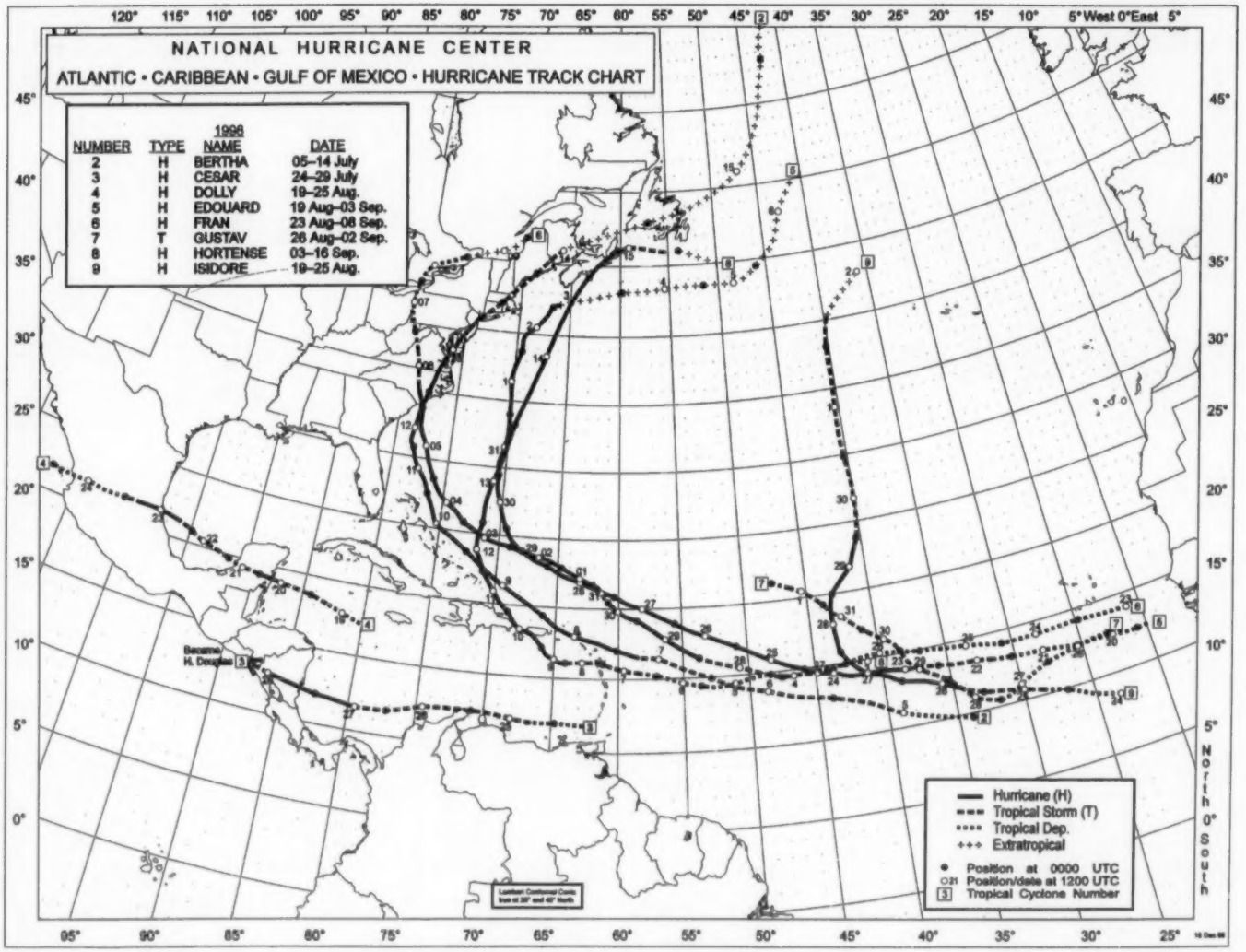
NATIONAL HURRICANE CENTER
ATLANTIC • CARIBBEAN • GULF OF MEXICO • HURRICANE TRACK CHART
1996
NUMBER TYPE NAME DATE
2 H BERTHA 05–14 July
3 H CESAR 24–29 July
4 H DOLLY 19–25 Aug.
5 H EDOUARD 19 Aug–03 Sep.
6 H FRAN 23 Aug–08 Sep.
7 T GUSTAV 26 Aug–02 Sep.
8 H HORTENSE 03–16 Sep.
9 H ISIDORE 19–25 Aug.
Became H. Douglas
Hurricane (H)
Tropical Storm (T)
Tropical Dep.
Extratropical
Position at 0000 UTC
Position/date at 1200 UTC
Tropical Cyclone Number
North 0° South
5° West 0° East 5°

Figure 2. Tracks of Atlantic Tropical Storms and Hurricanes, July - September, 1996.

Tropical Prediction Center

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observation. This would help NHC and other tropical cyclone warning centers to better evaluate the cyclone strength.

Incidentally, the *Dusseldorf Express* sailed through the western Caribbean Sea during November 1996. There it passed through the center of the low pressure system that later became Hurricane Marco. Its hourly observations again provided valuable information on the strength and extent of the surface winds and pressures.

III. Significant Weather of the Quarter

A. Tropical Cyclones - Please note that all tropical cyclone data should be considered preliminary, and that all dates and times are UTC.

1. Atlantic

Hurricane Bertha: Tropical Depression Two formed over the eastern Atlantic near 10N 34W on 5 July (Figure 2). The depression reached tropical storm strength later that day while tracking west-northwest. Bertha continued a general west-northwest motion through 9 July. It reached hurricane strength just before moving into the Leeward Islands on 8 July. The hurricane continued to intensify as it moved through the Virgin Islands on 8 July and to the north of Puerto Rico on 9 July. Bertha reached a peak intensity of 100 kt with an aircraft-measured minimum pressure of 960 mb while it was northwest of Puerto Rico on 9 July. The hurricane moved northwest just east of the Bahamas on 10-11 July, and the storm gradually turned north toward North Carolina on 12 July.

Gradual weakening had occurred from 10 July to 12 July. However, Bertha re-intensified early on 12 July and it had 90 kt winds when it made landfall near Wrightsville Beach and Topsail Beach, North Carolina, late on 12 July. Bertha moved north and then northeast just inland from the U.S. Atlantic coast as a weakening tropical storm. The system moved into New Brunswick on 14 July and became extratropical.

Bertha produced hurricane-force winds over parts of eastern North Carolina. An automated observing station at Frying Pan Shoals reported 77 kt sustained winds and gusts to 100 kt between 1600-1700 UTC on 12 July, with a minimum pressure of 977.5 mb at 1800 UTC. Hurricane-force winds also occurred over the northern Leeward Islands and Virgin Islands. Tropical-storm force winds were reported over parts of Puerto Rico, and over the mid-Atlantic and New England states. In addition, the ship *Aalsmeergracht* reported 66 kt winds at 0600 UTC July 12. Numerous other ships reported tropical-storm force winds.

Bertha hit many of the same Caribbean islands devastated by Hurricanes Luis and Marilyn in 1995. This resulted in additional damage to areas not yet recovered from previous tropical cyclone strikes. Monetary damage figures are not available for the Caribbean. Bertha's U.S. landfall caused an estimated $270 million in damage. So far, Bertha is directly or indirectly responsible for twelve deaths.

Hurricane Cesar: Tropical Depression Three formed over the southeastern Caribbean Sea near 12N 68W on 25 July (Figure 2). The depression moved west and became Tropical Storm Cesar later that day. Cesar continued west along the north coast of South America on 26 July, then moved into the southwestern Caribbean while reaching hurricane strength on 27 July. Cesar reached its peak intensity of 75 kt while moving onshore in eastern Nicaragua on 28 July. Cesar quickly weakened to a depression while over land. However, it completed the crossing of Nicaragua and went on to become Hurricane Douglas in the Eastern Pacific.

Cesar's path through the Caribbean resulted in 51 deaths, primarily due to heavy rain that produced flash flooding and mud slides. The largest reported death toll was in Costa Rica where 26 people died. No monetary damage figures are available.

Hurricane Dolly: Tropical Depression Four formed over the western Caribbean Sea near 19N 84W on 19 August (Figure 2). It became Tropical Storm Dolly later that day while moving west. Dolly reached minimal hurricane

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strength as it moved on to the east coast of Mexico's Yucatan Peninsula. Dolly continued a general westward track over Yucatan on 21 August while weakening to a tropical depression.

Dolly moved generally west-northwestward into the Bay of Campeche early on 22 August and quickly regained tropical storm status. It regained hurricane intensity later that day. Dolly reached a peak intensity of 70 kt and a minimum pressure of 989 mb at landfall between Tuxpan and Tampico, Mexico on 23 August. Dolly continued west-northwest and weakened to a low pressure system over land later that day.

Tampico reported 40 kt sustained winds with gusts to 60 kt at 1045 and 1145 UTC 23 August. In addition, ship *3EWJ9* (name unknown) reported 50 kt winds at 1200 UTC 20 August. Several Mexican stations reported heavy rains of 10-13 in.

Dolly's double strike on Mexico caused 14 reported deaths and destruction to hundreds of homes. No monetary damage figures are available at this time.

Hurricane Edouard: Tropical Depression Five formed near 13N 30W on 21 August (Figure 2). The system moved west and became Tropical storm Edouard the next day. Edouard continued west and reached hurricane strength on 23 August. Rapid strengthening occurred, and Edouard reached a peak intensity of 125 kt on 25 August as it turned west-northwest. The hurricane continued west-northwest on 27-28 August, passing north of the Leeward Islands and east of the Bahamas. A gradual turn to the north-northwest took place on 29-30 August. Edouard maintained 110-120 kt winds throughout these four days, with a minimum central pressure of 934 mb on 30 August.

Edouard turned north along longitude 70W/71W on 31 August, and this motion continued through 1 September. The hurricane was approaching New England on 2 September when it turned northeast out into the Atlantic. Edouard steadily weakened during this time, and it fell below hurricane strength before becoming extratropical near 43N 66W on 3 September.

Edouard affected parts of the New England States and the Canadian Maritimes with tropical storm-force winds. As of this writing, there are two reported deaths in the U.S. Damage was reported to be minor.

Hurricane Fran: Tropical Depression Six formed near 14N 25W on 24 August (Figure 2). The depression moved on a general westward track through 27 August with no development. It wasn't until 28 August that it became Tropical Storm Fran. Fran moved generally west-northwest from 28 August-3 September, then made a northwest turn on 4 September. The cyclone briefly reached hurricane strength on 29 August before weakening to a tropical storm the next day. During this time, it passed northeast of the Leeward Islands. Fran regained hurricane strength on 1 September, and slow strengthening continued through 4 September. On that day, Fran reached a peak intensity of 105 kt with an aircraft-measured minimum pressure of 946 mb.

Fran passed east of the Bahamas on 3-4 September, then it turned north-northwest toward the North . and South Carolina coasts on 5 September. The hurricane made landfall near Carolina Beach, North Carolina (just southwest of where Bertha had made landfall in July) early on 6 September as a Category 3 (100 kt winds) hurricane on the Saffir-Simpson scale. Fran weakened as it moved over the eastern U.S. and became extratropical over southeastern Canada on 7 September.

Ship *LAVX4* reported 85 kt winds about 60 nm northeast of the center at 1800 UTC 5 September. The automated station at Frying Pan Shoals reported 79 kt sustained winds, gusts to 108 kt, and a minimum pressure of 960.6 mb between 2100-2300 UTC 5 September. Topsail Beach, North Carolina, reported 65 kt sustained winds, and there are numerous yet unverified reports of higher winds along the coast.

Fran had a severe impact on the North Carolina coast, and its rains

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and winds were felt far inland over the mid-Atlantic states. The storm directly or indirectly produced 34 reported deaths, most of which were due to flash flooding. The U.S. damage estimate is $3.2 billion as of this writing.

Tropical Storm Gustav: Tropical Depression Seven formed near 11N 32W on 27 August (Figure 2). Initially moving west, it turned northwest on 28 August as it became Tropical Storm Gustav. Gustav continued northwest through 31 August, then moved west-northwest through the rest of its existence. Unlike Edouard and Fran preceding it, Gustav struggled in an unfavorable environment. It reached a peak intensity of 40 kt on 29 August, and weakened to a depression on 1 September. Gustav dissipated near 21N 48W on 2 September. Gustav stayed far from land, and there are no reports of damage or casualties.

Hurricane Hortense: Tropical Depression Eight formed near 15N 47W on 4 September (Figure 2). The system moved west with little development through 6 September, then reached tropical storm strength as it moved through the Leeward Islands on 7 September. On 8-9 September, Hortense followed an erratic west-northwest track through the northeast Caribbean to just south of Puerto Rico. The intensity was equally erratic, and Hortense didn't reach hurricane strength until 9 September. The hurricane moved west-northwest across the southwest tip of Puerto Rico and along the north coast of the Dominican Republic on 10 September. It was a Category 1 hurricane on the Saffir-Simpson Scale during this time. Hortense turned northwest and strengthened on 11 September while passing near the Turks and Caicos Islands.

Hortense turned north away from the Bahamas on 12 September and began rapid intensification. It reached a peak intensity of 120 kt with an aircraft-measured minimum pressure of 935 mb near 0000 UTC 13 September. The hurricane turned north-northeast later that day, and this general motion continued until it made landfall in Nova Scotia on 15 September as a Category 1 hurricane. Hortense became extratropical near 47N 58W later on 15 September.

Hortense produced gusts to hurricane force on several Caribbean islands, but the primary impact was rain. Anywhere from 10 to 20 in of rain fell over the Virgin Islands, Puerto Rico, and the Dominican Republic as Hortense crept through the region. Hurricane conditions also affected the Turks and Caicos Islands, the southeast Bahamas, and Nova Scotia. Mayaguana in the Bahamas reported 65 kt sustained winds with gusts to 78 kt at 2245 UTC 11 September, while St. Paul's Island, Canada, reported 66 kt sustained winds with gusts to 82 kt at 0742 UTC 15 September. In addition, ship *ELRI2* (name unknown) reported 58 kt winds at 1800 UTC 9 September and 0000 UTC 10 September.

Hortense had a devastating impact in Puerto Rico. The torrential rains caused flash floods and mud slides that killed a reported 18 people. An additional three people were reported killed in the Dominican Republic along with 21 missing. More than 11,000 homes were reported damaged or destroyed. Monetary damage figures are not complete as of this writing. There are no damage or casualty reports from elsewhere along the storm track.

Hurricane Isidore: Tropical Depression Nine formed in the eastern Atlantic near 10N 26W on 24 September (Figure 2). Moving west-northwest, it reached tropical storm strength on 25 September and hurricane strength on 26 September. Isidore reached a peak intensity of 100 kt on 27 September while turning northwest. The hurricane turned north on 28 September, then it moved northeast the next day while weakening to a tropical storm. A final northward turn occurred on 30 September, and Isidore weakened to a depression before it became extratropical near 37N 40W on 1 October. Isidore remained far from land, and there are no reports of damage or casualties.

2. Pacific

Tropical Storm Cristina: Tropical Depression Five-E formed near

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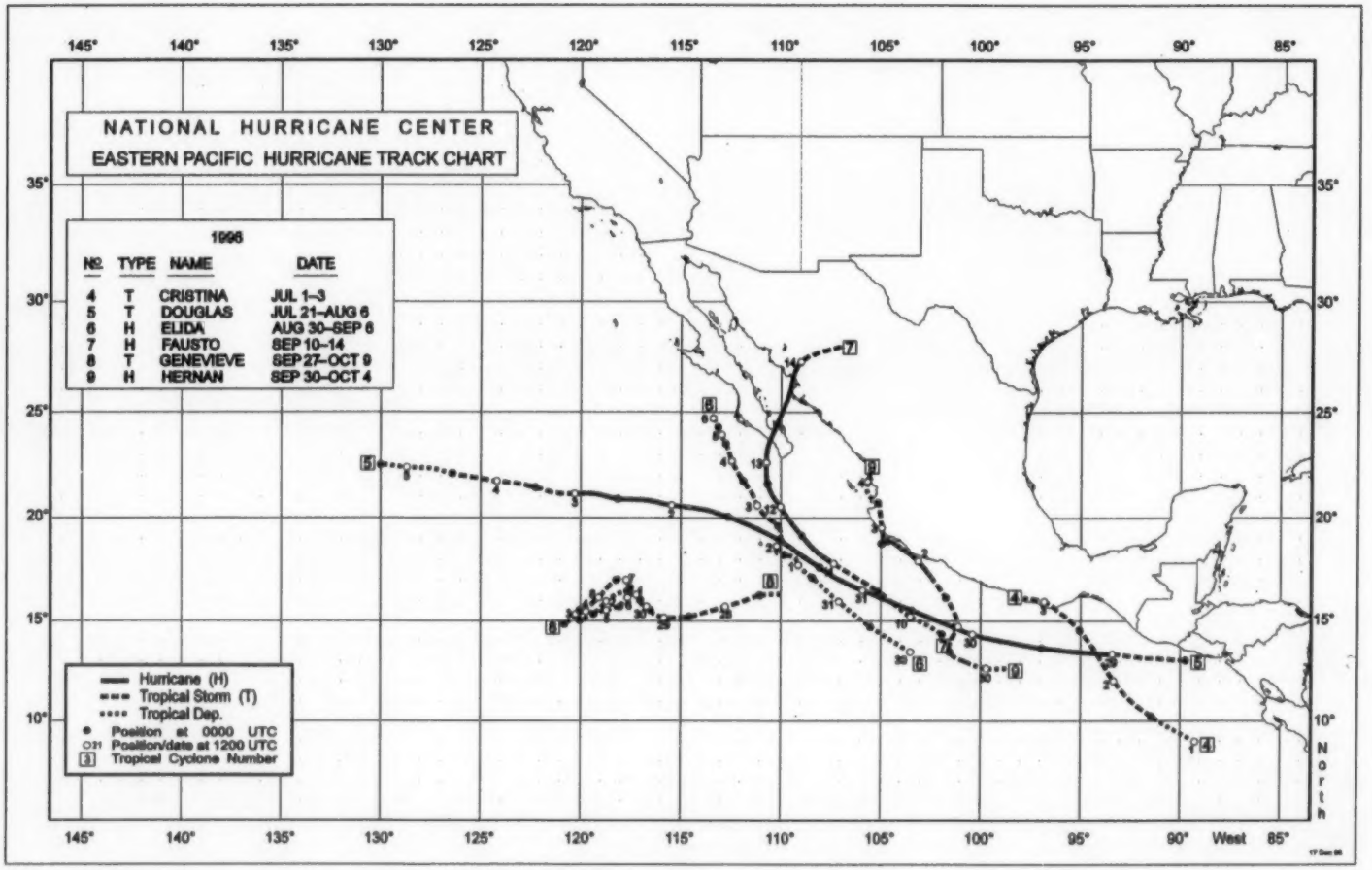
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№ TYPE NAME DATE
4 T CRISTINA JUL 1–3
5 T DOUGLAS JUL 21–AUG 6
6 H ELIDA AUG 30–SEP 6
7 H FAUSTO SEP 10–14
8 T GENEVIEVE SEP 27–OCT 9
9 H HERNAN SEP 30–OCT 4
Hurricane (H)
Tropical Storm (T)
Tropical Dep.
Position at 0000 UTC
Position/date at 1200 UTC
Tropical Cyclone Number
145° 140° 135° 130° 125° 120° 115° 110° 105° 100° 95° 90° 85°
35° 30° 25° 20° 15° 10°
West
North

Figure 3. Tracks of Eastern Pacific Tropical Storms and Hurricanes, July - September, 1996.

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10N 91W on 1 July (Figure 1). It was the third tropical cyclone to form in that general area in 10 days. Moving northwest, it became Tropical Storm Cristina the next day. Cristina reached a peak intensity of 60 kt as it made landfall on the Mexican coast on 3 July. It dissipated over the Mexican mountains later that day.

In addition to its encounter with the *Dusseldorf Express*, Cristina affected parts of the Mexican coast previously affected by Hurricanes Alma and Boris. There are no confirmed reports of damage or casualties, although NHC has received unconfirmed reports of up to 24 people missing.

Tropical Depression Six-E: Tropical Depression Six-E formed near 18N 110W on 5 July. It dissipated the next day just north of where it started. The maximum winds in this short-lived system were estimated at 30 kt. Although this system was near Socorro Island, there are no reports of damage or casualties.

Hurricane Douglas: This system was the continuation of Atlantic Hurricane Cesar. Remains of Cesar moved into the Pacific near 13N 90W on 29 July (Figure 3). Rapid re-development occurred, and the cyclone reached tropical storm, then hurricane strength later that day. Douglas moved west through 30 July, then it moved west-northwest from 31 July through 2 August. The hurricane reached a peak intensity of 115 kt on 1 August. Douglas turned west on 3 August as it weakened to a tropical storm. This motion continued as Douglas weakened to a depression on 5 August, and it dissipated the next day near 23N 132W.

Douglas was upgraded to a hurricane based on an observation from ship *Tritonhighway*, which reported 69 kt winds and a 1004.0 mb pressure at 1500 UTC 29 July. Several other ships reported tropical-storm force winds.

Although Douglas affected parts of the west coasts of Central America and Mexico as it re-developed, there are no reports of damage or casualties over these areas.

A records check shows that the last tropical cyclone to cross from the Atlantic to the Eastern Pacific was Hurricane Joan in 1988, which became Tropical Storm Miriam.

Tropical Storm Elida: A long lull in tropical cyclone activity occurred in the Eastern Pacific after Douglas. It ended when Tropical Depression Eight-E formed near 18N 110W on 1 September (Figure 3). The depression drifted north and became Tropical Storm Elida the next day. Elida drifted northwest on 3 September while reaching a peak intensity of 55 kt. The cyclone then moved north on 4-5 September. It weakened to a depression 5 September, and Elida dissipated the next day near 25N 113W.

Although Elida affected Socorro Island and parts of Baja California, there are no reports of damage or casualties.

Hurricane Fausto: Tropical Depression Nine-E formed near 14N 102W on 10 September (Figure 3). The cyclone tracked northwest for the next two days, reaching tropical storm strength late on 10 September and hurricane strength on 11 September. Fausto reached a peak intensity of 105 kt on 12 September. The hurricane recurved north-northeast on 13 September and made landfall near Todos Santos, Mexico (on the Baja California peninsula) with 75 kt winds later that day. Fausto moved across the Gulf of California on 14 September, and it hit mainland Mexico near Los Mochis with 65 kt winds. The cyclone dissipated over land later that day.

TPC received an amateur radio report from San Jose del Cabo, Mexico, of 60 kt sustained winds with gusts to 75 kt. In addition, ship *3FPM5* (name unknown) reported 35 kt winds at 1500 UTC 12 September. Fausto caused one reported death in Baja California. Widespread minor damage occurred in the landfall area, but there are no reports of monetary damages.

Tropical Storm Genevieve: Tropical Depression Ten-E formed near 16N 110W late on 27 September (Figure 3). The cyclone reached tropical storm strength later that day as it moved west-

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southwest, and this motion persisted through the next day. Genevieve reached a peak intensity of 45 kt on 28 August, and slow weakening occurred until the system became a depression near 0000 UTC 1 October. Then, it was moving slowly northwest through the open ocean. Genevieve lasted well into October and there will be more in the next issue's column.

Hurricane Hernan: Tropical Depression Eleven formed on 30 September near 13N 99W (Figure 3). The system moved northwest and reached tropical storm strength later that day. Hernan strengthened into a hurricane and hit Mexico during the first week of October, and the rest of the story is included in the article concerning the fourth quarter of 1996.

B. Other significant weather events - There were no other significant weather events in TPC's area of responsibility during the quarter. However, a volcanic eruption on the island of Monsterrat (the strongest in a one-and-a-half-year long sequence of eruptions) sent an ash column to 45,000 ft on 18 September. This caused ashfalls over Monsterrat, Guadeloupe, and the adjacent waters. While this had a significant impact on local aviation, there were no reports of damage or problems to mariners.

Volcanic eruptions can cause hazards to mariners. Large ash plumes can travel large distances from the erupting volcanoes, and if large enough can cause reduced visibility due to darkness and volcanic ash fall. Ash accumulations on ships can cause problems such as damage to engines and hazardous travel on deck. Finally, ships can be caught in the direct force of an eruption if they are too close to the vent. A ground-hugging blast destroyed seventeen of eighteen ships moored at St. Pierre, Martinique, along with the town, on May 8, 1902.

Acknowledgment: Andrew Shashy of TPC's Tropical Analysis and Forecast Branch contributed greatly to this column by obtaining the information on the *Dusseldorf Express*.⚓

Observing Hurricane Fran with an Automated Surface Observation System

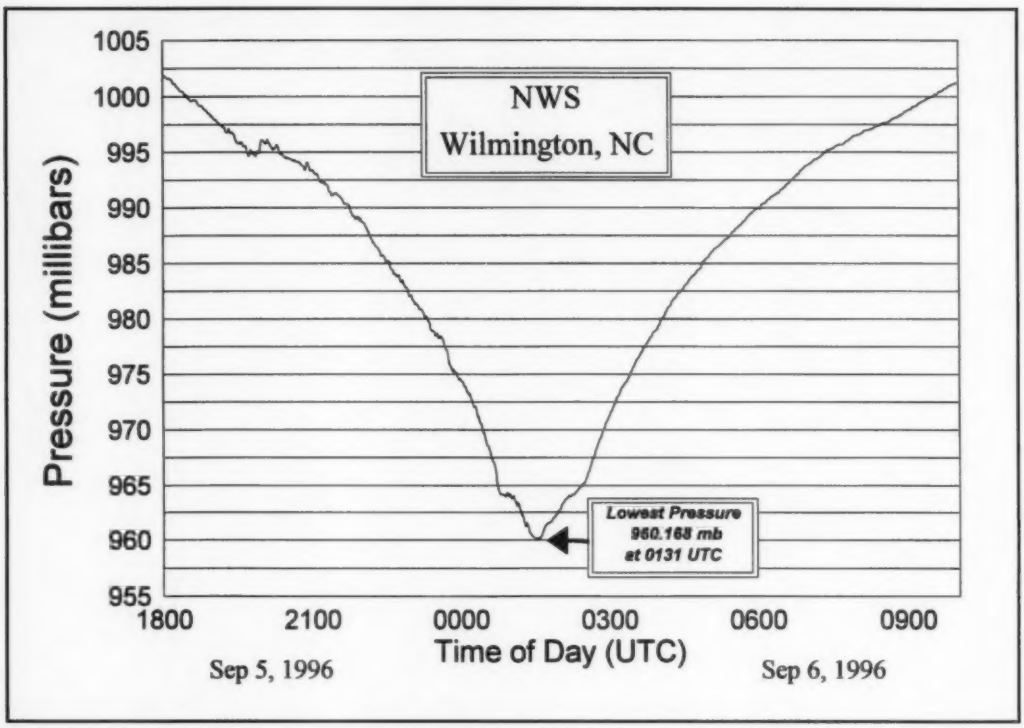
Reid Hawkins
Science and Operations Officer
Wilmington, North Carolina

On September 5, 1996, Hurricane Fran ripped through the eastern half of North Carolina and South Carolina. This was the second hurricane to pass through the Cape Fear Region in less than two months. As the center of Fran moved onshore near Bald Head Island, it left a trail of destruction with many boats and homes damaged or destroyed from the storm surge, winds, and fallen trees.

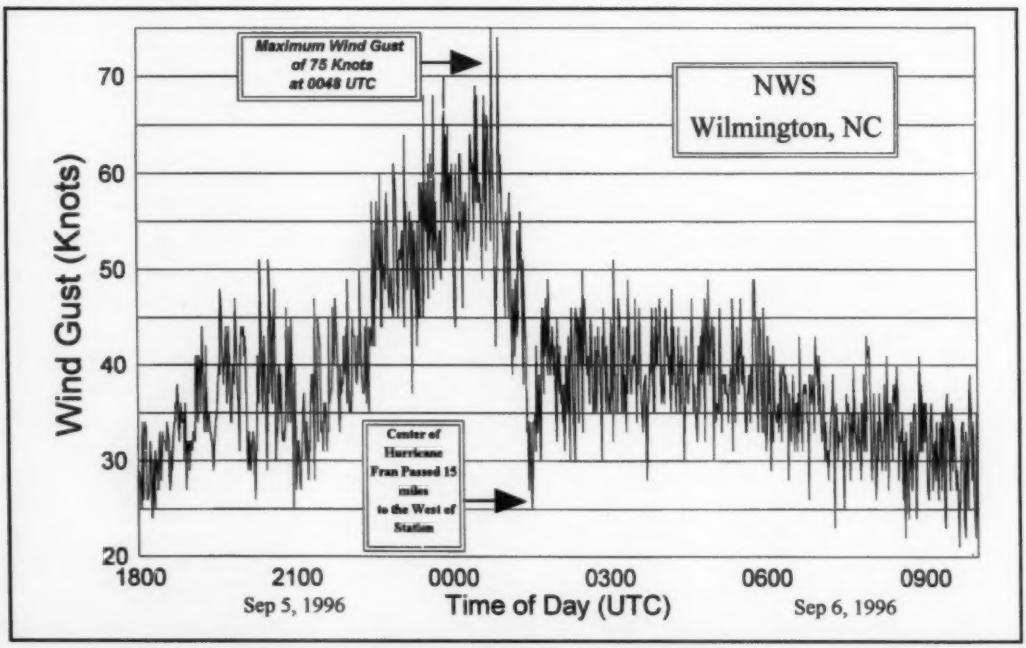
The National Weather Service's Automated Surface Observation System (ASOS) in Wilmington, North Carolina, operated continuously through Hurricane Fran. The reason for ASOS's continuous operation was its power was supplied by a Federal Aviation Administration generator that ran uninterrupted throughout the event. ASOS and the NWSO ILM are located at the New Hanover International Airport which is 6 miles from the Atlantic Ocean.

One of the features with ASOS is the ability to download one minute digital data that includes visibility, present weather, pressure, wind direction, wind speed, and wind gust. The archiving of digital data is a manual process in which a member of the staff must place a 3.5" computer floppy into the ASOS unit and select a series of commands to download the data. If the one-minute digital data are not archived within 12 hours, it is lost forever. The ILM observation staff diligently downloaded the data several times throughout Hurricane Fran, thus saving the data for posterity, and it was later learned that this was the first complete set of ASOS 1-minute data to be archived during a hurricane.

After the data were archived, a spreadsheet program was used to construct a pressure trace and a wind and gust chart. (See charts on page 38.) Now the NWSO ILM has a complete surface observational record of its first major Hurricane since Hazel in 1954.⚓



ASOS's 1-minute pressure trace during Hurricane Fran at the NWS Wilmington, North Carolina



ASOS's wind gust trace during Hurricane Fran at the NWS Wilmington, North Carolina

Tropical Prediction Center Report

October through December 1996

Dr. Jack Beven
Andrew Shashy
Tropical Prediction Center
Tropical Analysis and Forecast Branch

I. Introduction

The active 1996 Atlantic hurricane season continued through the quarter with four named tropical cyclones. In addition, a non-tropical system in the North Atlantic developed some satellite characteristics of a tropical cyclone in November. The eastern Pacific contributed two holdover storms from September as well as a late season tropical depression. Two episodes of gale- to storm-force winds in the Atlantic and Gulf of Mexico associated with anticyclones rounded out the significant weather of the quarter.

II. TPC Products on Radiofax and Other Services

The TPC provides marine weather analyses, warning forecasts, and GOES-8 satellite imagery for the tropical Atlantic, the Caribbean Sea, and the Gulf of Mexico. Most of these products are transmitted via Radiofax from the U.S. Coast Guard station in New Orleans, Louisiana. Also available is a streamline analysis for the tropical East Pacific Ocean which is transmitted via Radiofax from Point Reyes, California. All of the marine weather charts, except for satellite imagery, are also available online via Internet address: **http://www.nws.noaa.gov/fax/marine.shtml**.

The Radiofacsimile Program originating at the Tropical Prediction Center and disseminated through the U.S. Coast Guard in New Orleans, Louisiana, has gone through significant changes since December 10, 1996. On that date, the TPC began to include satellite imagery over the region from 12S to 44N between 28W and 112W as well as 2-hour block-format in the scheduled transmission of marine analyses and warning forecasts, and special announcement messages. Based on user comments, the radiofax schedule was revised again on February 4, 1997 to improve product timeliness. Tropical Surface Analyses and Forecasts

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are transmitted from the U.S. Coast Guard at synoptic hours (i.e., 00, 06, 12, and 18 UTC). They are valuable marine weather charts for fishing and recreational users, transoceanic users, pleasure cruise liners, and and others involved in offshore marine activities.

A new feature was implemented in the Tropical Surface Analysis (TSA) on February 4, 1997, as 24-hour forecasts of synoptic weather features were included on the maps. An X enclosed by a circle and a number denotes a 24-hour forecast of a high center and its central pressure, and an X with a number denotes a 24-hour forecast of a low center and its central pressure. Twenty-four hour forecasts of frontal systems are also depicted on the TSA.

Simultaneous broadcast frequencies from the U.S. Coast Guard station (NMG) New Orleans, Louisiana, are: 4317.9 KHZ, 8503.9 KHZ, and 12789.9 KHZ. Select a carrier frequency 1.9 KHZ below those listed when using a single sideband radio in the upper side band (USB) mode to receive this broadcast. Additional information can be obtained by phone: (305) 229-4470, fax: (305) 553-1264, or by writing to Chief Tropical Analysis and Forecast Branch (TAFB), Tropical Prediction Center, 11691 SW 17th Street, Miami, Florida 33165-2149.

The current TPC/USCG New Orleans radiofax schedule is given in Table 1.

Please note that this schedule is available via the Internet from the TPC Web site at URL **http://www.nhc.noaa.gov/**.

In addition, the Atlantic High Seas forecast is available over the "Perfect Paul" computer voice translator from the U.S. Coast Guard in Chesapeake, Virginia. Table 2 gives the transmission times and frequencies.

III. Significant Weather of the Quarter

A. Tropical Cyclones - Please note that all tropical cyclone data should be considered preliminary, and that all dates and times are UTC.

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Table 1. TPC/Coast Guard New Orleans radiofax product transmission schedule.

Transmission Time (UTC)	Product Description
0000	Tropical Surface Analysis/24 HR Forecast (1800 UTC previous day)
0030	Gulf Wind/Wave Forecast (1200 UTC/0600 UTC)
0055	Atlantic High Seas Forecast (2200 UTC previous day, text)
0120	Gulf of Mexico Surface Analysis (1800 UTC previous day)
0135	United States Surface Analysis (1800 UTC previous day)
0150	GOES-8 IR Tropical Satellite Image (2345 UTC previous day)
0205	Request for Comments
0600	Tropical Surface Analysis/24 HR Forecast (0000 UTC)
0630	Radiofax Product Schedule
0655	Atlantic High Seas Forecast (0400 UTC, text)
0720	Gulf of Mexico Surface Analysis (0000 UTC)
0735	United States Surface Analysis (0000 UTC)
0750	GOES-8 IR Tropical Satellite Image (0545 UTC)
0805	Gulf Wind/Wave Forecast (1200 UTC/0600 UTC)
1200	Tropical Surface Analysis/24 HR Forecast (0600 UTC)
1230	Gulf Wind/Wave Forecast (0000 UTC/1800 UTC)
1255	Atlantic High Seas Forecast (1000 UTC, text)
1320	Gulf of Mexico Surface Analysis (0600 UTC)
1335	United States Surface Analysis (0600 UTC)
1350	GOES-8 IR Tropical Satellite Image (1145 UTC)
1405	Product Notice Bulletin
1800	Tropical Surface Analysis/24 HR Forecast (1200 UTC)
1830	Radiofax Product Schedule
1855	Atlantic High Seas Forecast (1600 UTC, text)
1920	Gulf of Mexico Surface Analysis (1200 UTC)
1935	United States Surface Analysis (1200 UTC)
1950	GOES-8 IR Tropical Satellite Image (1745 UTC)
2005	Gulf Wind/Wave Forecast (0000 UTC/1800 UTC)

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1. Atlantic

Tropical Storm Josephine: A frontal system moved into the southwestern Gulf of Mexico in late September. This triggered a persistent but unorganized area of disturbed weather associated with a broad low pressure area. The low gradually became better organized, and Tropical Depression Ten formed near 23N 96W late on 4 October (Figure 1). The cyclone moved slowly north then east on 5 October, and the eastward motion continued on 6 October as the system reached tropical storm strength. Josephine turned northeast on 7 October as it reached a peak intensity of 60 kt with an aircraft-measured minimum pressure of 981 mb. The cyclone was losing tropical characteristics as it made landfall over Taylor County, Florida, early on 8 October. The system became extratropical a few hours later over southern Georgia.

Ex-Josephine continued northeast through the eastern U.S., the Canadian Maritimes and Atlantic provinces, and the adjacent Atlantic Waters through 10 October. The storm remained vigorous with gale-force winds across much of the region. The extratropical cyclone was last seen over the Atlantic west of Ireland on 13 October.

There are numerous ship reports of tropical-storm force winds from Josephine. The *R. HAL DEAN* reported 58 kt winds and a 998.6 mb pressure at 1800 UTC 7 October, while the *PRESIDENT GARFIELD* simultaneously reported 45 kt winds and a 994.1 mb pressure. The Sunshine Skyway in Tampa Bay reported 39 kt sustained winds with gusts to 62 kt, which are the highest from any land station.

No deaths are directly attributed to Josephine, and damage in the U.S. is estimated at $130 million.

As Josephine first developed, a large high pressure system moved into the eastern U.S. This produced an area of gale- to storm-force winds over the northern Gulf of Mexico separate from the winds associated with Josephine. There are numerous reports of 35-50 kt winds from ships and oil rigs during the period from 3-6 October. By 7 October, Josephine had intensified and moved far enough north that the northern Gulf winds became part of its circulation.

Tropical Storm Kyle: An area of disturbed weather developed over the western Caribbean on 9 October. This area developed into a tropical depression on 11 October between Belize and Swan Island, and it became Tropical Storm Kyle later that day. Kyle reached a peak intensity of 45 kt late on 11 October with a aircraft-measured central pressure of 1001 mb. Rapid weakening followed, and Kyle totally dissipated as it moved ashore near the Guatemala-Honduras border on 12 October.

There are no significant ship reports associated with Kyle, and there are no reports of damage or casualties.

Hurricane Lili: Disturbed weather persisted over the western Caribbean after Kyle's demise. Tropical Depression Twelve formed from this weather near 13N 80W on 14 October (Figure 2). The cyclone moved generally northwest from 14-17 October, although a couple of small loops occurred during this time. The cyclone reached tropical storm

Table 2. "Perfect Paul" High Seas forecast transmission schedule and frequencies (in USB mode).

Transmission Time (UTC)	Frequency (MHz)
0400	4426, 6501, 8764
0530	4426, 6501, 8764
1000	4426, 6501, 8764
1130	6501, 8764, 13089
1600	6501, 8764, 13089
1730	8764, 13089, 17314
2200	6501, 8764, 13089
2330	6501, 8764, 13089

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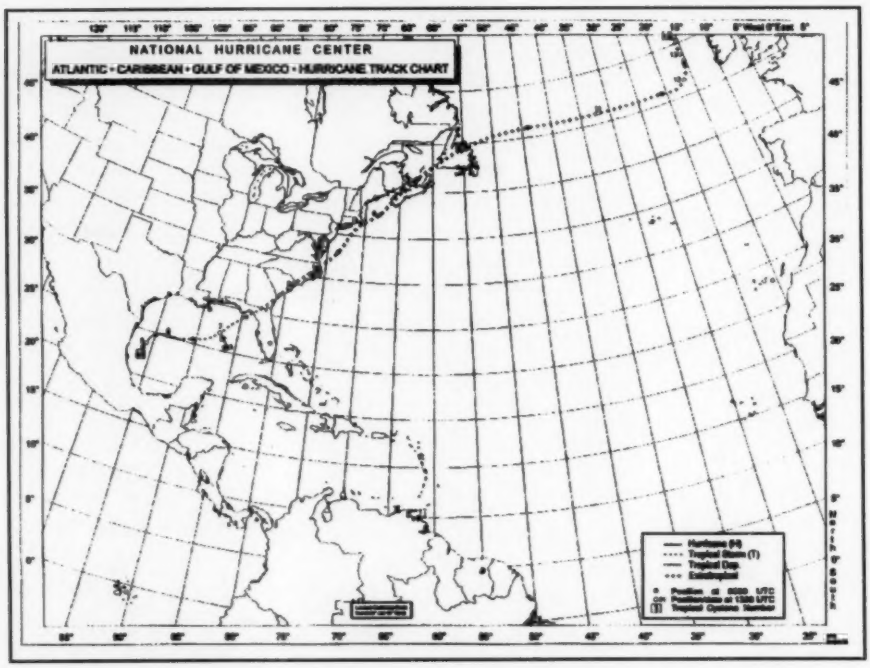

Figure 1. Best track positions for Tropical Storm Josephine, October 1996.

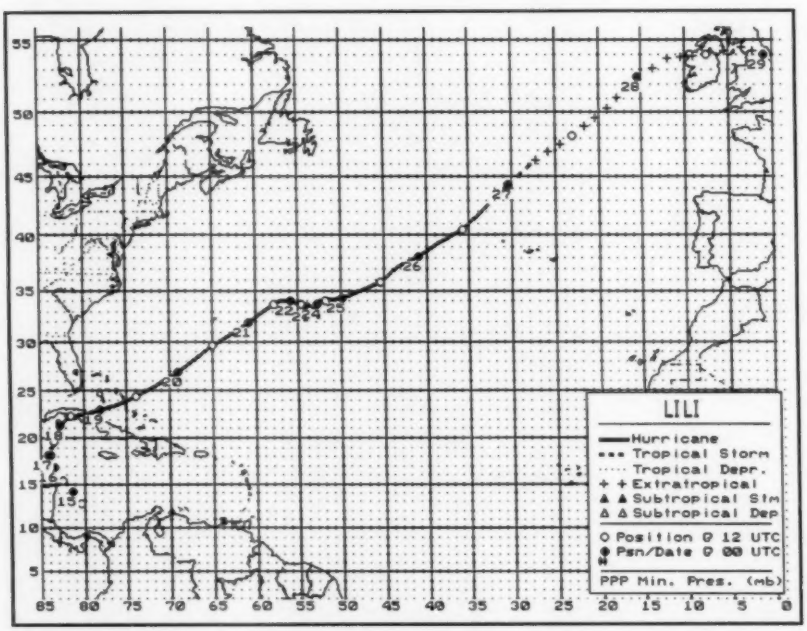

Figure 2. Best track positions for Hurricane Lili, October 1996.

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strength on 16 October and hurricane strength the next day. Lili turned north-northeast later on 17 October, and this motion persisted until the hurricane made landfall over western Cuba on 18 October. Lili turned east across Cuba, then it assumed an east-northeast track that took it through the central Bahama Islands on 19 October. On this day, the storm reached a peak intensity of 100 kt with an aircraft-measured central pressure of 960 mb.

Lili continued east-northeast on 20-21 October, passing south and east of Bermuda while weakening. The storm slowed to an eastward drift on 22 October, and this general motion continued into 25 October. The cyclone weakened to a minimal hurricane on 23 October, then re-intensified to an 85 kt insity on 25 October. Lili accelerated northeast and weakened late on 25 October, and this motion continued until the storm became extratropical near 46N 27W on 27 October. Ex-Lili remained a vigorous system as it tracked through the British Isles on 28-29 October.

Most ships avoided Lili, as TPC has only four reports of 34 kt or higher winds. However, the storm passed almost directly over the *ZCBC3* (name unknown), which reported 99 kt winds and a 967.7 mb pressure at 1200 UTC 19 October. Land stations Cayo Largo del Sur, Cuba, and San Salvador, Bahamas, reported 80 kt sustained winds at 1050 UTC 18 October and 1000 UTC 19 October respectively, with a gust to 104 kt reported at the Cuban station.

Lili left a track of damage extending from Central America across Cuba to the Bahamas. Eight deaths were reported in Honduras and Costa Rica due to flooding from heavy rains, which also affected parts of Nicaragua. There are no reports of casualties from Cuba or the Bahamas. However, there was widespread damage to agriculture and homes in Cuba, and some property damage in the Bahamas. No monetary damage figures are available. In addition, ex-Lili is credited for causing six deaths in the British Isles.

Hurricane Marco: Disturbed weather associated with a broad low pressure area formed over the southwest Caribbean Sea on 13 October. This system gradually organized and became a tropical depression near 17N 79W late on 16 October (Figure 3). The depression drifted erratically southwest and south, finally reaching tropical storm intensity on 19 October. Marco turned east late on 19 October, and this motion continued the next day as it reached a peak intensity of 65 kt and an aircraft-measured minimum pressure of 983 mb. The cyclone turned northeast later on 20 October, and this motion continued on 21 October as it weakened to a tropical storm. Marco then moved slowly east until 23 October, when it turned back to the west and weakened to a tropical depression. Marco regained tropical storm strength on 24 October as it turned northwest, and this motion continued into 26 October. On that day, Marco turned southwest and again weakened to a depression. The cyclone was absorbed into a cold front late on 26 October near 20N 85W.

An unidentified U.S. Navy ship reported 63 kt winds and a 998 mb pressure at 0600 UTC 20 October as Marco became a hurricane. The *JO SPRUCE* reported 56 kt winds at 1200 UTC 25 October as Marco re-intensified.

Marco never made landfall. However, its large circulation produced heavy rains and mudslides over Central America and Hispaniola which killed 8 people.

A remarkable aspect of Marco was large and quick changes in intensity. A reconnaissance plane indicated an 11 mb fall in central pressure in 1 hr 40 min on 20 October. Similar, though less extreme, central pressure falls occurred on 21 and 22 October.

Possible Tropical Cyclone: An extratropical low developed near 38N 63W on 15 November. It initially moved east, then during the period 16-18 November it performed a series of loops over the area from 38N-42N between 57W-61W. Organized convection started developing near the center on 17 November, and by 19 November the system showed some satellite characteristics of a tropical storm. The cyclone started

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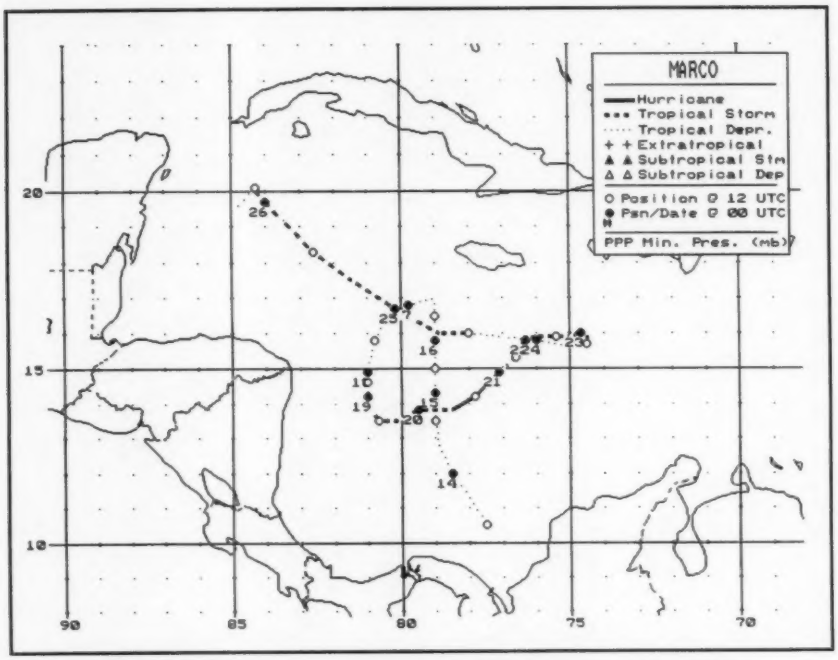


Figure 3. Best track positions for Hurricane Marco, October 1996.

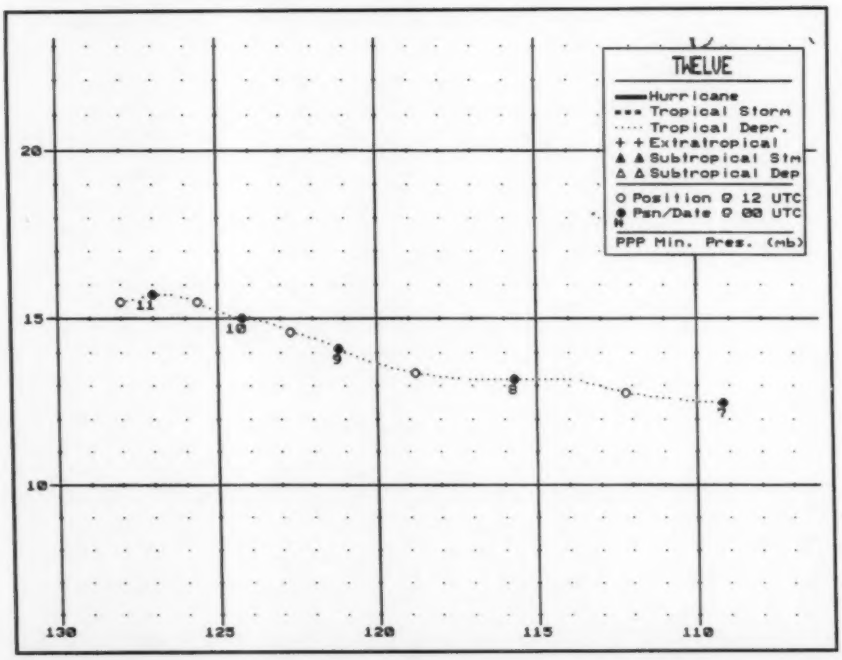


Figure 4. Best track positions for Tropical Depression Twelve-E, November 1996.

Tropical Prediction Center

Continued from Page 43

an east-northeast track on 19 November, which continued through 21 November when the system turned east. The storm lost all possible tropical characteristics on 22 November, and it was absorbed by a cold front near 44N 25W later that day.

There are numerous reports of gale- to storm-force winds to 60 kt associated with the extratropical phase of the system (including hurricane-force gusts from Sable Island), and satellite scatterometer data indicates 35-40 kt winds associated with the system on 20 November. However, there are no surface reports from near the center during the possible tropical phase. Therefore, there is still uncertainty as to whether this system meets all the criteria of a tropical cyclone, particularly in view of where and how it developed. The Tropical Prediction Center would welcome any reports from ships who encountered this storm, particularly between 17-21 November.

2. Pacific

Tropical Storm Genevieve: The early history of Genevieve, as well as the best track, were given in the previous article. At the start of October, Genevieve was a tropical depression near 16N 117W. For the rest of its life, it looped aimlessly over the area from 14N-17N between 117W-121W. The cyclone regained tropical storm strength on 6 October and maintained 35-40 kt winds until 8 October. The system again weakened to a depression late that day, and it dissipated near 15N 121W on 9 October.

The *NEDLLOYD DEJIMA* reported 35 kt winds at 1800 UTC 7 October, which was the only report of tropical-storm force winds. There are no reports of damage or casualties.

Hurricane Hernan: At the start of October, Hernan was a 35 kt tropical storm moving northwest off the Mexican coast (see the best track figure in the previous article). The storm briefly turned north, then resumed a northwest track on 2 October as it reached hurricane strength and a peak intensity of 75 kt. Mexican radar data indicated the eye made a loop around 0000 UTC 3 October just off the Mexican coast, then moved north and made landfall near Barra de Navidad later that day. The weakening cyclone moved slowly north along the coast near Puerto Vallarta and dissipated late on 4 October.

The strongest winds observed during Hernan were from the *LONDON ENTERPRISE*, which reported 40 kt winds and a 999.1 mb pressure at 1800 UTC 1 October.

No deaths are attributed to Hernan. TPC received reports indicating that 100 were injured and 1,000 homes damaged in Mexico.

Tropical Depression Twelve-E: Tropical Depression Twelve-E formed near 13N 109W on 7 November (Figure 4). The cyclone moved west-northwest through 10 October, when it turned west. It dissipated near 16N 128W on 11 October. Maximum sustained winds were estimated at 30 kt.

B. Other significant weather events - A significant high wind episode occurred over the western Atlantic, Florida, most of the Gulf of Mexico, and the northwest Caribbean from 11-19 November. A strong high pressure system over the eastern U.S. was mainly responsible for the winds, although the low pressure area that became Hurricane Marco also played a part (Figure 5). The extraordinary feature of this event was the duration. Gale winds occurred over much of the area during 13-17 November, with 20-33 kt winds present the rest of the time. It is interesting that the winds decreased as Marco reached tropical storm strength on 19 November.

There are numerous reports of gale force winds at the height of the event, including gusts of 35-45 kt over and near south Florida. Beach erosion and minor wind damage occurred in south Florida, along with power outages due to downed lines and salt deposits on power lines.⚓

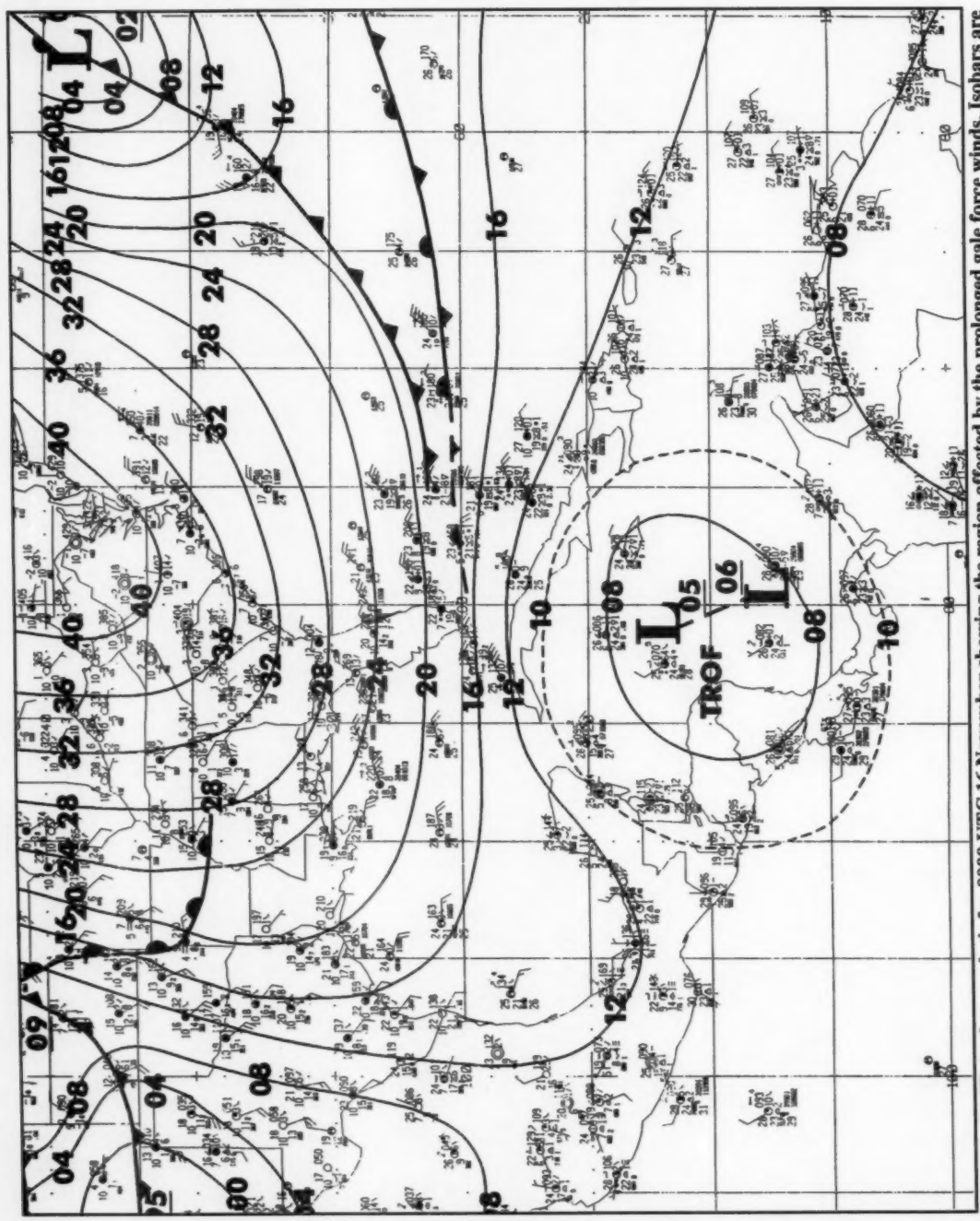
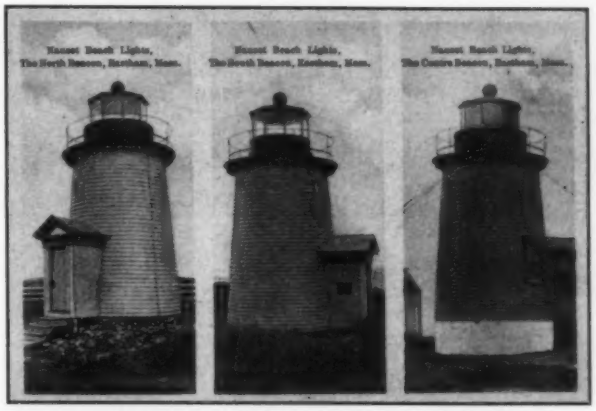


Figure 5. TAFB surface analysis for 0000 UTC 16 November showing the region affected by the prolonged gale force winds. Isobars are every 4 hPa.

Nauset Beach Lighthouse

Elinor De Wire
Gales Ferry, Connecticut



When erosion threatened the original "Three Sisters of Nauset," they were replaced in 1892 by these three wooden (movable) lights erected about 30 feet to the west. Spaced 150 feet apart, the trio served to light the North Eastham coast up until 1911. ***Photo credit: Nauset Light Preservation Society.***

High on the steep bluffs of Cape Cod's Nauset Beach stands a weatherworn cast iron lighthouse. Its revolving signal of alternate red and white flashes duplicates the conspicuous daymark, a bright, candy-stripe color scheme seen 19-miles at sea. It overlooks a panorama of sea, sky, scrub pines, and dunes and is the guardian of centuries of cape history.

Here, the Nauset Indians traded corn and beans with the Pilgrims long ago, and countless castaways washed ashore from shipwrecks after running amok of the cape's notorious backside perils. Their misfortunes would result in Houses of Refuge—tiny, weatherbeaten shacks with basic supplies for survival—and launch the U.S. Lifesaving Service, a precursor to the Coast Guard whose intrepid members were dedicated to search and rescue.

Somewhere beneath the drifted dunes of Nauset, under the vigilant beam of the red and white tower, also can be found the footprints of American literary "beacon" Henry David Thoreau, who walked the entire length of the cape twice to experience its raw power and beauty. Henry Beston was drawn here too, and lived a solitary existence in his famed "Outermost House."

When Thoreau passed by in the 1840s, three tiny lighthouses stood side-by-side on Nauset Beach. They were still there when Beston lived in his tiny cottage at the turn-of-the-century. These triple beacons—designed to differentiate themselves from the numerous white, fixed lights of the cape—were barely 30-feet tall and stood 300-feet apart. Sailors affectionately called them the Three Sisters, because of their resemblance, from a distance, to three ladies in white dresses and black bonnets.

Over the decades, erosion toppled several sets of triplet towers, and their foundations now lie submerged under the sea, as do the sands where Thoreau and Beston walked. The most recent set of triple towers, built in 1892, served only three decades before being deemed frivolous and an obvious case of "overlighting." At the beginning of the 20th century the triple lights were discontinued, upstaged by beacons with flash

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Nauset Beach Lighthouse

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sophisticated characteristics. Nauset Beach still needed a lighthouse, however, and the Bureau of Lighthouses didn't have to look far to find one.

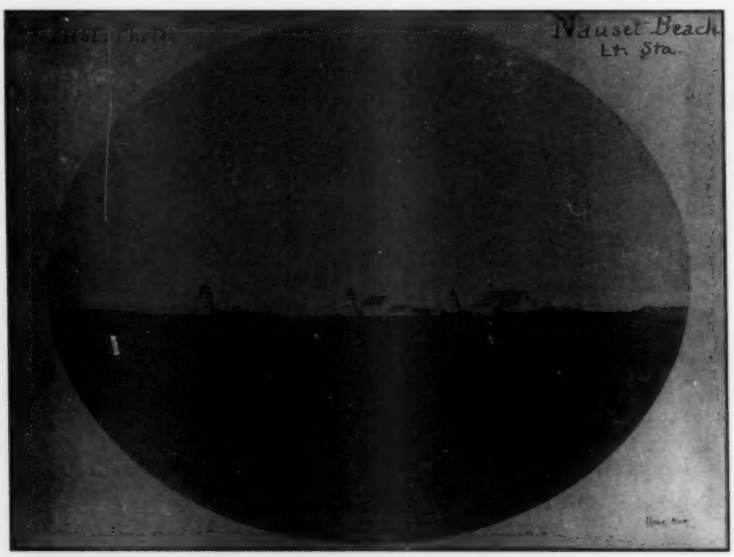
Chatham, some 15 miles south, had cast iron twin lights that had been built in the 1870s. About 1920, the 48-foot tall north twin was deemed unnecessary and was darkened. Three years later, it was dismantled and moved by barge up the cape to Nauset Beach. There it was bolted to an exposed concrete perch on the high bluffs some 115-feet above the sea. A fourth-order prism lens was installed, fueled by kerosene and powered by clockworks with huge weights suspended in the tower. The lightkeeper, George Herbolt, had to wind up the weights every eight hours.

The old, handsome keeper's house from the Three Sisters' site was moved next to the tower. There were few trees on the beach in those days and the lighthouse was the most conspicuous structure. It was also a safe distance from the cliff's crumbling edge. In 1940 the tower was painted with a bright red stripe to set it apart from its neighboring beacons at Chatham and Truro. As if to preserve the nostaglia of the defunct Three Sisters lighthouses, the beacon flashed three times every ten seconds.

Over the years, Nauset Light served quietly in its picturesque setting. Summer tourists enjoyed being photographed with the pretty sentinel in the background, and weddings were sometimes held on the grounds of the station. The keeper's cottage was occupied by numerous Lighthouse Service and Coast Guard personnel. The last resident keeper of the light was Eugene Coleman, who left his post in 1952. The lighthouse was made automatic with the installation of a modern aerobeacon. The unneeded keeper's house was sold and has been since occupied by private individuals.

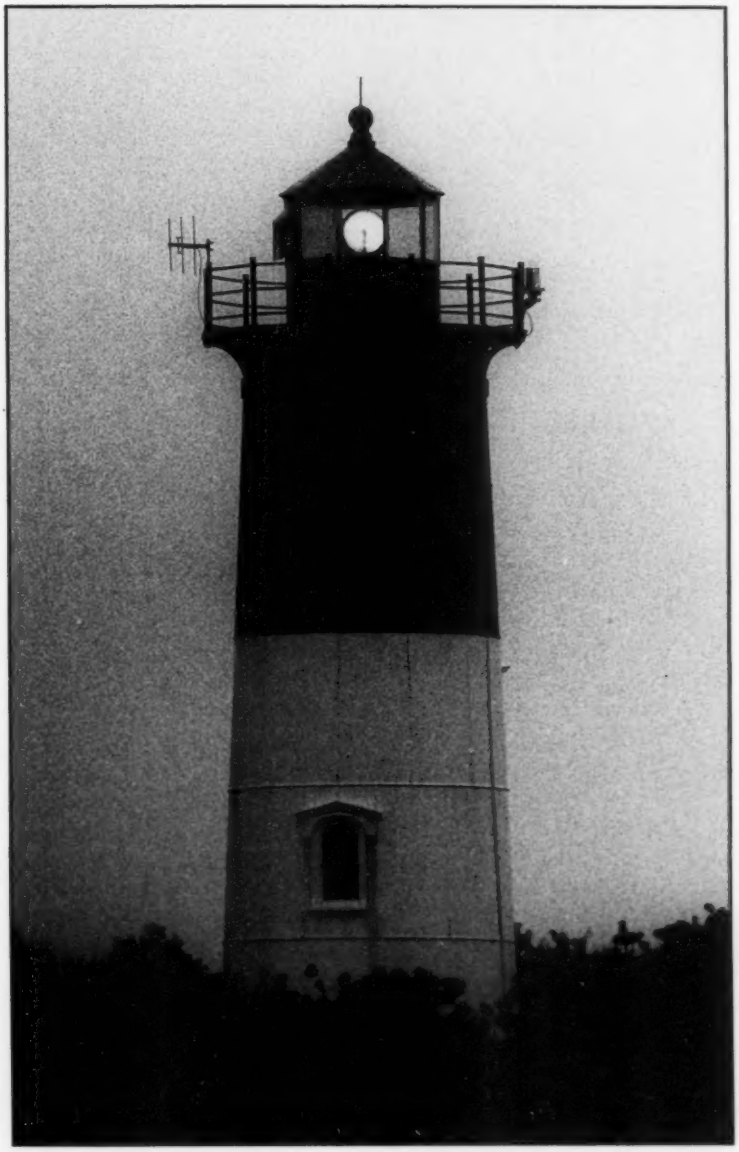
In winter, storms and wind pound the cape, weathering away the steep cliff at Nauset—sometimes consuming as much as three feet of ground per year. The entire backside of the cape—from elbow to fingertips—is moving westward, and no amount of shoring up the beach will halt its march. This has been a concern at many light stations on the cape and the primary reason Nauset Light is built of cast iron plates. If erosion threatens, it can be moved back from the sea.

In the early 1990s, the Coast Guard, realizing the Nauset Lighthouse would soon fall over the cliff, announced plans to decommission it. Residents of the cape could not imagine Nauset Beach without its beautiful lighthouse. It had been admitted to the National Register of Historic Places some years earlier, and there was no argument as to its historic significance. The Nauset Light Preservation Society quickly formed, and efforts began to raise funds for the relocation of the lighthouse. The little garage built for the first keeper in 1926 was turned into a gift shop and donation station.



The Three Sisters of Nauset, Circa 1890

Continued on Page 49



Nauset Lighthouse (one of the former turn lights at Chatham).

Nauset Beach Lighthouse

Continued from Page 48

The tower's new site, a safe distance from the cliff, was donated by the National Park Service. Funding was provided also by the Federal Intermodal Surface Transportation Enhancement Act and the Massachusetts Department of Environmental Management. The relocation process was begun in the fall of 1996 by International Chimney Corporation of Buffalo, New York, a firm which had successfully moved two other lighthouses.

A special cross steel and dolly system was designed to move the tower after it was hoisted out of its old foundation. The dolly had a unique three-point suspension to keep the tower level on its downhill journey to the new site about 300-feet southwest of the original location. The historic oilhouse also was moved to the new site. Eventually, it is hoped the historic keeper's cottage will join the tower in the new location.

The diminutive Three Sisters Lighthouses were not lost either. After post-lighthouse careers as summer cottages and concession stands, they were bought by the National Park Service, refurbished, and moved to a site safe from the sea where they are interpreted for visitors. As the only set of triple lighthouses ever to serve in the United States they are historic emblems of our seafaring heritage and an era when the technology of illumination was in its infancy.

For more information on Nauset Light, contact the Nauset Light Preservation Society, P.O. Box 941, Eastham, MA 02642. To learn more about the Three Sisters Lighthouses, contact The Cape Cod National Seashore, Wellfleet, MA 02667.⚓

Drifting Buoys Monitor Tropical Storm Genesis in Eastern Atlantic

Michael K. Burdette
Data Systems Division
National Data Buoy Center
Stennis Space Center, Mississippi

The National Data Buoy Center conceived and coordinated an effort to deploy an array of 14 drifting buoys in the Eastern Tropical Atlantic Ocean to monitor tropical storm genesis during the peak of the 1996 Atlantic Hurricane Season. The Pre-Storm Array Project brought several key Government elements together to focus their time, talent, and resources to test the concept of monitoring developing tropical weather systems in remote areas with small free drifting data buoys. Participants in the project include the National Hurricane Center (NHC); the Hurricane Research Division (HRD) and Physical Oceanography Division of the Atlantic Oceanographic and Meteorological Laboratories; and the 53rd Weather Reconnaissance Squadron (WRS), U.S. Air Force Reserves.

The eastern tropical Atlantic between the Lesser Antilles and the Cape Verde Islands is well known as a tropical storm genesis area. In a practical sense, the mid to latter part of the North Atlantic Hurricane Season is often referred to as the "Cape Verde Season." During this time from early August through November, a large number of weather systems referred to as "Easterly Waves" drift westward from the African continent over the eastern Atlantic Ocean. If they encounter warm surface waters and favorable atmospheric conditions, they can undergo transformation to a tropical depression, tropical storm, or hurricane.

The Pre-Storm Array Project focused on deploying drifting buoys in an area from 10 to 21 N., 30 to 46 W. (Figure 1). This is an area in the eastern tropical Atlantic through which a large number of named storms have traveled during the climatological peak of the season, through recorded history. The slow westward trend of the ocean currents and the noted absence of large dynamic oceanographic features in this part of the Atlantic assist in both keeping the array intact and in the area of interest. With drift speeds of only two to six miles per day, the buoys will continue monitoring passing tropical weather systems for the remainder of the hurricane season. Other primary factors influencing the focus in this area were that it is typically data void except for satellite and ship observations and is east of and well outside the area normally tasked for hurricane reconnaissance flights. It was also learned that the Caribbean Meteorological Organization, through the International South Atlantic Buoy Program Committee sanctioned by the World Meteorological Organization, had requested the committee to encourage drifting buoy deployments in this region for obvious reasons.

The pre-storm array consists of 14 drifting buoys, of which 4 are wind speed and direction (WSD) type as shown in the photograph, and 10 are surface velocity profiler with barometer (SVP-B) type. Both of these buoy types transmit data through the National Oceanic and Atmospheric Administration Polar Orbiting Environ-

Continued on Page 51

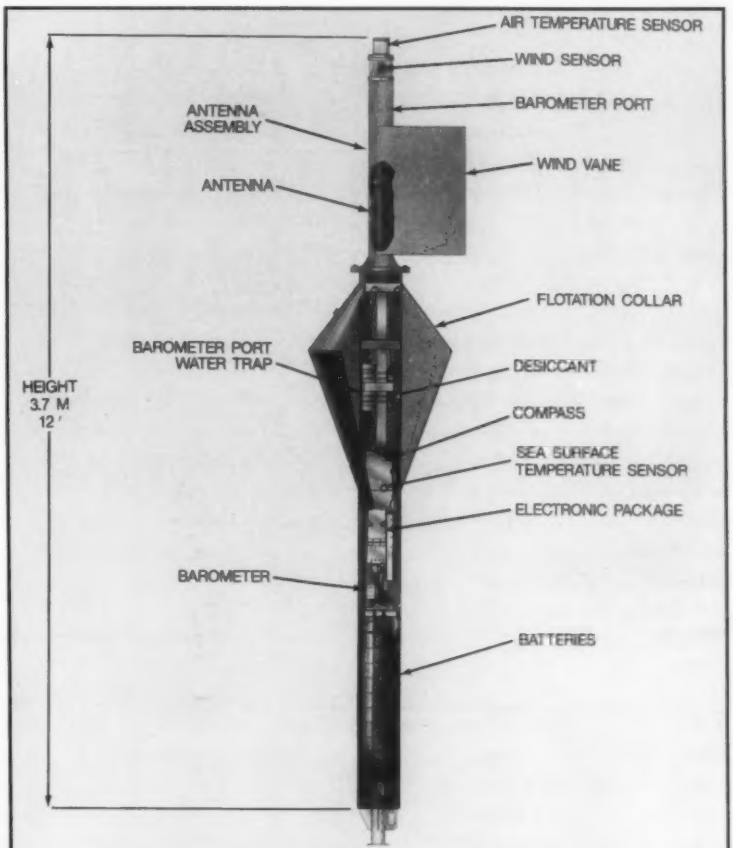
Drifting Buoys

Continued from Page 50

mental Satellites. The data are further relayed to ground receiving stations, processed, and distributed by Service Argos Inc. Distribution of the data is to NHC, HRD, and various other meteorological centers throughout the world. The WSD drifting buoy has sensors that measure wind speed, direction, and gust; barometric pressure; air temperature; and sea surface temperature. Positions are calculated at the Service Argos Processing Center using frequency shift data provided by the satellite. The buoy also stores 3 previous hours of data and transmits them with the most recent data, thus providing a 4-hour time history of surface observations. The SVP-B buoys sample barometric pressure and sea surface temperature. These buoys transmit their position along with previous hours of data. With a satellite in view of the array four to six times per day, the resulting data represent observations from most of the 24 hours each day.

The buoys were deployed by C-130 aircraft through cooperation of the 53rd WRS and began operating in early August to coincide with the climatological peak of the 1996 Atlantic Hurricane Season. Since their deployment, the buoys have continuously transmitted near-real-time surface observations, and they have sampled various tropical weather systems that have moved over the array. The first opportunity to sample a system came very soon after deployment, when a tropical wave moved by on August 18 and 19. Shortly thereafter, from August 23 to 24, Tropical Storm Eduoard entered the array and intensified to hurricane strength while being sampled by the array. The center of Hurricane Eduoard moved within 25 miles of buoys 41614 and 41611 during storm passage. Buoy 41611 showed a minimum barometric pressure of 986.0 hPa on August 24. The 1-m level winds were 22 m/s with gusts to 30.8 m/s. A 90-degree wind shift was noted over a 3-hour period on the 24th with a 180-degree overall wind shift during storm passage. Buoy 41614 provided similar data (Figure 2). During the passage of Hurricane Eduoard, the array was also instrumental in providing sea surface temperature data to fine-tune satellite-derived sea surface temperature fields; this played a key role in forecasting the storm's intensification. Later, from August 26 to 27, Tropical Depression #6 (later named Fran) moved generally east to west through the array. The center came very close to buoy 41611, which measured a

Continued on Page 52



WIND SPEED/DIRECTION (WSD) DRIFTING BUOY

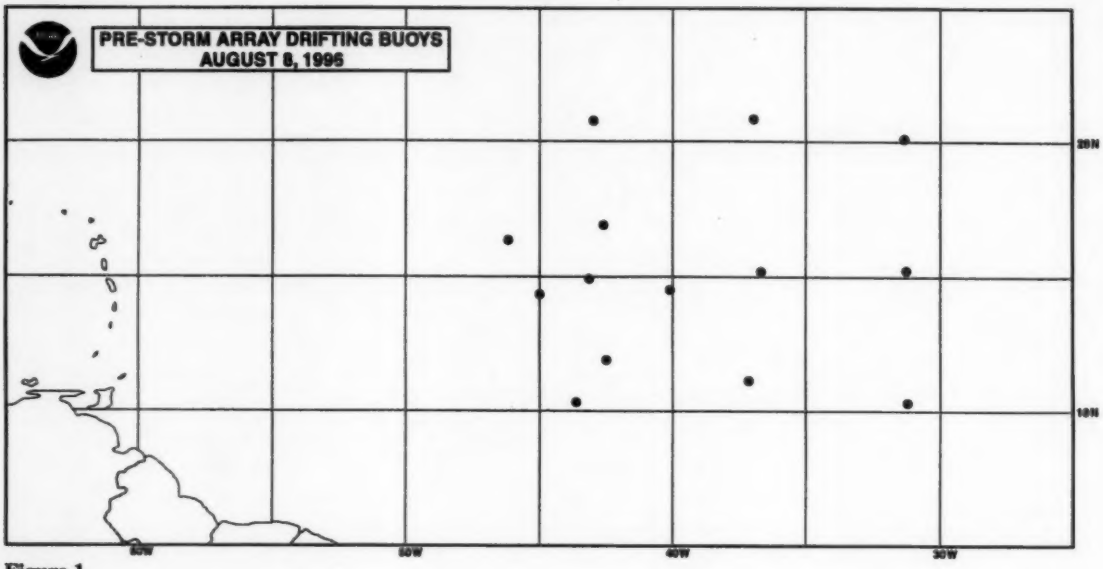


Figure 1

Drifting Buoys

Continued from Page 51

minimum pressure of 1006.6 hPa at 1300 UTC on August 27. Three of the WSD drifting buoys measured the associated wind shift with Tropical Depression #6. Buoy 41611 showed an overall 130-degree wind shift during passage. These are but some of the examples of useful measurements that have been provided by the array since its establishment in early August. The buoys will continue to produce high-quality surface observations in this data void area for the remainder of the 1996 Hurricane Season. Furthermore, as the winter season arrives, it is expected that the buoys will provide a bonus. As they drift into the western Atlantic and turn northeastward, they potentially will provide useful data for mid-latitude winter storm monitoring.⚓

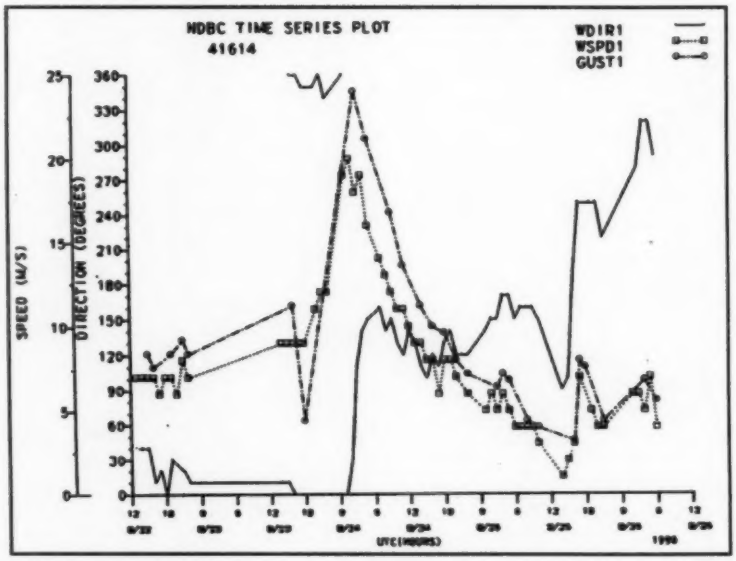


Figure 2

AMVER Program—

Automated Mutual-Assistance Vessel Rescue System

Richard T. Kenney
United States Coast Guard
Maritime Relations Officer

"Why do I bother sending in AMVER reports," you might ask. "I've been sending them for five, ten, fifteen years and my ship has never once been called on to assist in an AMVER rescue." One of the benefits of AMVER participation is that the more ships "on the plot" the less chance each ship has of being asked to divert. The annual AMVER award certificates and pennants (on the anniversary years) recognize those ships who "only stand and wait."

But each year, some 200 AMVER ships are called upon to respond to an emergency at sea. Many effect dramatic rescues, often at risk to their own ships and crews. Up until a few years ago, there was little or no recognition for this heroism. But now, thanks to the interest and support of several corporations and organizations, some special awards have been established and reserved for AMVER-participating ships. Among them are:

The International Rescue at Sea Award

This award was established in 1992 by LLP, Ltd. (formerly Lloyds of London Press), and is fast becoming one of the most prestigious international awards for extraordinary rescues at sea. It generally recognizes the "rescue of the year" by a ship participating in AMVER. Criteria for selection include: number of persons saved; value of property saved; difficulty of the rescue; extraordinary distance of the diversion, or time consumed in search and rescue efforts; and exercise of command, control, and/or coordination at the scene of the distress. The award consists of a plaque and the distinctive red AMVER pennant and is presented at a major maritime event in the country of the winner.

The PTT Telecom Netherlands Rescue Award

This award, established in 1996, is sponsored by Station 12 Maritime Satellite Communications, and is presented to an AMVER participating ship that responded to an emergency in which satellite communications were essential to either alerting rescue coordinators to the distress, or were essential to the prosecution of the search and/or rescue effort. The award highlights the value of a direct communications link among ships, or between ships and rescue coordinators, to expedite a response in situations where time is

Continued on Page 54

AMVER Program

Continued from Page 53

always of the essence, or to provide status reports or medical advice while enroute. The award consists of a plaque and $1,000 worth of free satellite time for the crew of the award-winning ship.

The Association for Rescue at Sea (AFRAS) AMVER Award

This award was inaugurated in 1996 by this non-profit, charitable-status foundation devoted to supporting services concerned with saving lives at sea and promoting the importance of safety in concert with other maritime and aviation organizations. Selection criteria for this award include: seamanship; shiphandling; degree of effort involved in the rescue; and the ship's initiative in responding. The distinctive award plaque is presented by AFRAS at its annual award ceremony held at the United States Capitol Building in Washington, D.C.

The Safety at Sea Magazine AMVER Award

This latest award will be presented for the first time at the Safety At Sea and Marine Electronics (SASMEX) Maritime Exhibition and Conference in Baltimore, Maryland on April 30, 1997. This award will highlight the value of the various components of the Global Maritime Distress and Safety System (GMDSS) in alerting and assisting in the coordination of search and rescue response. AMVER ships involved in rescues brought about by EPIRBs, INMARSAT or DSC alerts will be considered for selection. The form of the award is still under consideration.

Make Sure AMVER Is Aware of any Rescues Made in 1996!

Selection for each of the awards is made from a list of nominees meeting the criteria assembled by AMVER officials at the end of each calendar year. All AMVER ships, of all nations, are eligible for consideration. In all cases, a panel of experts in the field of search and rescue reviews case files to determine the most deserving ship for each award. However, unless a rescue is coordinated by a U.S. Coast Guard Command Center, the details of a rescue, or the very rescue itself, may not be known to the AMVER staff. This article is written to encourage any ships involved in AMVER rescues during 1996 to send information to the AMVER Maritime Relations Office in New York to ensure consideration for any ship/crew deserving of any of these awards.⚓

Former U.S. Coast Guard Commandant, ADM James Gracey, USCG (Ret.), presents inaugural AFRAS Award to Ms. Rebecca Frailey, U.S. General Agent for Glafki (Hellas) Shipping Co., on behalf of *M/V Nissos Thera*.

Coastal Forecast Office News

Taunton, Massachusetts NWSFO

Tom Fair

The tropical storm was the "buzz" word of concern in our waters this summer (Summer 1996). On July 11, 1996, when tropical storm Bertha was located east of Jacksonville, Florida, a ship 200 miles south of New England reported a 17-foot swell with a period of 10 seconds. On the afternoon of July 13, Bertha lie centered over New York City and SSE winds of 50 kts covered our waters South of New England. By the evening of July 13, 40-50 knot winds covered George's Bank and Nantucket Shoals along with significant seas of 20 feet.

On September 1, Hurricane Edouard was centered between New York City and Bermuda with winds between 40 and 60 kts over most of that distance, along with the category 4 Saffir-Simpson hurricane strength near the center. One again, 15-foot seas were reported by the George's Bank and Nantucket Shoals buoys. Early on September 2, with a central pressure of 961 mb, Edouard was centered close to 40°N 70°W. A ship 120 miles SE of the center experienced a south wind of 70 kts with seas of 40 feet and swells of 34 feet. Fortunately, Edouard began moving northeast sparing most of New England; however, Cape Cod had winds to hurricane force and many boats were torn from their moorings and dropped ashore. At sea, deep water lobster pots were disturbed and tangled at 40 fathoms. On September 3, Bertha covered the area from Sable Island to Cape Cod with winds of 30-50 kts.

Still more was to follow and by September 14, Hortense was well northwest of Bermuda. Although surface weather maps in our office had few ship reports near Hortense, the forecast models assured us that Hortense would pass well southeast of Cape Cod, posing another threat to George's Bank and Nantucket Shoals. On the afternoon of the 14th, Hortense slammed the banks with hurricane force winds and a central pressure of 951 mb.

Although hurricane and tropical storms are often much smaller in size than winter storms, and their extreme winds are confined very close to the center, it is evident that at sea there is a very large area of 30 to 50 kt winds with most of these storms, due to the pressure gradient of the storm itself or to the gradient created between a tropical storm and an abutting area of high pressure. This is clear reason for all mariners to maintain their weather watch. And to avoid, when possible, the most severe conditions associated with these tropical systems.

Seattle, Washington NWSFO

Bill Burton, Marine Focal Point

A new NOAA weather radio station is now on the air in western Washington state. WWG-24 NOAA Weather Radio Puget Sound made its debut in November broadcasting at 162.425 MHz from Millner Peak just west of Port Townsend. This new weather radio station provides American

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Coastal Forecast Office News

Continued from Page 55

flood and weather forecast and warning information for the first time to areas like the San Juans, Bellingham, and the Strait of Juan de Fuca, as well as south into Puget Sound.

Puget Sound weather radio joins other NOAA weather radio stations in western Washington near Seattle, Olympia, Neah Bay, Astoria, and Portland. NOAA weather radio broadcasts the latest weather forecasts and information 24 hours a day. It also has a warning alarm feature alerting you to impending hazardous flood and weather warning information in an instant, as part of the Emergency Alert System or EAS. NOAA weather radio is also an all-hazards warning system.

NOAA weather radio Puget Sound is a marine weather oriented station. Much of the Seattle station's marine weather and northwest interior area public forecasts have moved to this new station. Since January 1, 1997, these forecasts air only on WWG-24 Puget Sound, permitting Seattle weather radio programming to cycle more quickly.

WWG-24 Puget Sound Weather Radio programming includes marine weather synopsis; marine forecasts for Puget Sound, Camano Island to Port Roberts, Strait of Juan de Fuca, and the coast; Canada's west coast of Vancouver Island marine forecast; extended marine forecast out to five days; expanded list of area marine weather and pressure reports; the northwest interior of western Washington public forecast, including the short-term forecast; western Washington extended forecast out to five days. In addition, any flood or weather watches, warnings or advisories will air as needed.

Miami, Florida NWSFO

Michael O'Brien

The hurricane season in the Atlantic was above normal and in the Caribbean it was very active. During the months of July through September there were about 60 days of named storms. However, of these, only about 25 days encompassed the forecast areas of the southwest North Atlantic or the Caribbean.

Hurricane Bertha affected the extreme northeast Caribbean for one day and then the southwest North Atlantic for six days and finally ended making landfall in North Carolina. Hurricane Cesar was in the western Caribbean for three days, Hurricane Dolly formed in the northwest Caribbean and made landfall just one day later in Mexico. Hurricane Edouard was in the southwest North Atlantic for three days before moving northward out of the region. Hurricane Fran, after five days in the Atlantic forecast area, made landfall in North Carolina. Finally, the last hurricane of September, but not the last of the season, Hortense, affected the northeast Caribbean for three days and struck Puerto Rico and the Dominican Republic before moving into the southwest North Atlantic where it spent three more days, finally moving northward out of the area.

Lest it seem that mariners were beset by stormy weather for about one-third of the summer, the relative size of the gale force wind area should be compared with the size of the forecast area. Even a large hurricane will have gales covering less than 25 square degrees—an approximation that holds true if you don't go too near the poles. The Caribbean encompasses roughly 250 square degrees, while the southwest North Atlantic covers about 330 square degrees. So gales and stronger winds cover, at most, 5 percent of the total area and usually it is closer to 1 or 2 percent at any one time. But because the storms do move, they will typically affect about 10 to 20 percent of the total area during their lifetime. This underlines a mariner's need for a forecast of the storm trajectory. There is a high probability that the boat and crew will have to move from harm's way one or more times during the tropical storm season.⚓

Voluntary Observing Ship Program

Martin Baron
National Weather Service

A Note of Thanks From the National Weather Service

The National Weather Service (NWS) thanks the thousands of ships officers participating in the Voluntary Observing Ship (VOS) Program. Taking observations from aboard ship, formatting them into the Ships code, and transmitting them real-time is an effort worthy of our highest praise. We acknowledge your work with much gratitude.

For the foreseeable future, ship reports will continue to be of great importance to weather forecasting. Your observations provide the meteorologist with information about actual local weather conditions, and for marine areas, ships are usually the only source of such information. Ship reports are especially important for production of the marine surface analysis, a fundamental meteorological guidance product. Most weather forecasts begin with a review of the data on the surface analysis. This analysis contains isobars (lines of equal barometric pressure) which makes it possible to locate weather systems such as fronts, troughs, high and low pressure areas, and tropical storms. Barometric readings from ships provide the data needed to draw the isobars over marine areas. For vast expanses of ocean, the surface analysis could not be produced without ship reports.

Please continue following the weather reporting schedule for ships as best you can -- REPORT WEATHER AT 0000, 0600, 1200, 1800 UTC. This is the worldwide reporting schedule for all marine areas. There is also a 3-hourly reporting schedule for vessels operating within 300 miles of names tropical storms or hurricanes, also in effect worldwide. The United States and Canada also request 3-hourly reports from within 200 miles of the United States and Canadian coastlines, and from the Great Lakes (these nearshore areas suffer from a severe shortage of data).

A Word about Data Accuracy

Great care must be taken at all times to ensure the accuracy of your data. Make sure your equipment is properly calibrated. Sea water thermometers should be

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VOS Program

Continued from Page 57

calibrated annually, and checked at every opportunity. If your vessel has an anemometer, it should be calibrated once every 6 months. Make sure the anemometer is located where the ships superstructure will not interfere with air motion. A PMO should calibrate your barometer and barograph once every 3 months and check your psychrometer during every ship visit. The recommended interval between PMO ship visits is 3 months. When recording dry and wet bulb temperatures, take your psychrometer to the windward side of the ship.

When estimating wind speed using the beaufort scale, remember that heavy rain and floating ice will damp down the sea surface, and can cause an underestimate of wind speed. When wind speed is increasing or decreasing, there is a lag time before any changes occur to the sea surface. Wind blowing against the tide or against a strong current will cause a greater than normal sea-disturbance, and may result in an overestimate of wind speed. On the other hand, wind blowing in the same direction as the tide or current will result in a smaller sea-disturbance than normal, and could cause an underestimate of wind speed. The presence of swell may cause more whitecaps to form, because sea waves have a greater tendency to break when superimposed on swell. When any of these factors are present, please remember to adjust your beaufort scale wind estimate accordingly.

NWS VOS Program Size and Scope

As of June 15, 1997, there were 1737 Vessels in the NWS VOS Program. This makes it the largest real-time data acquisition program in the world (the NWS land based substation program has more observing sites (nearly 12,000) but these are mainly climatology stations and do not report data real-time. The breakdown by World Meteorological Organization classification is as follows:

Selected Class	493
Supplementary Class	492
Auxiliary Class	615
Great Lakes Class	87
Local Moving Ships	50

The vessel areas of Operation include:

Atlantic Ocean (includes Gulf of Mexico, Carribean Sea)	719
Pacific Ocean	718
Great Lakes	87
Other areas (includes Indian Ocean and Mediterranean Sea)	213

The breakdown of vessels by ownership:

Commercial	1543
U.S. Coast Guard	91
Navy	80
NOAA	23

New Recruits

During the Period July 1, 1996 through March 31, 1997 (we have nine months of catch-up to do in this MWL issue), PMOs recruited 115 vessels into the VOS program. Thank you for joining the program! Please call on any of the PMOs listed in the back of this publication for assistance. PMOs spend most of their time visiting ships in support of the VOS program, and are anxious to help you. They have all the forms, handbooks, and instructions you'll need to observe and report weather. In some cases, the PMO provides vessels with instruments on loan.

Vessel Awards for 1996

We are pleased to announce that 38 vessels and two shipping companies have received awards for outstanding support to the VOS Program for 1996. All VOS program vessels make an important contribution, and we regret that only a very small number of ships receive awards each year. PMOs submit nominations for awards to the national VOS program office in Silver Spring, Md, where the final selections are made.

Continued on Page 59

VOS Program

Continued from Page 58

For 1996, awards for outstanding support to the VOS program were presented to:

Ships

Arktis Light
Belgrano
Banda Seahorse
Burns Harbor
Chastine Maersk
Chevron South America
Duncan Island
Export Patriot
George A. Sloan
ITB Groton
ITB Mobile
Kaye E Barker
Kapitan Konev
Mark Hannah
Maria Laura
Medusa Challenger
McKinney Maersk
New Nikki
NOAA Ship Chapman
NOAA Ship Oregon II
NOAA Ship Whiting
Nomzi
Oleander
Paul R. Tregurtha
Philip R. Clark
President Polk
Rubin Kobe
Sealand Integrity
Sealand Voyager
Stephen J
Tillie Lykes
Tropical
Tyson Lykes
USCGC Storis
USNS Pathfinder
Westward Venture
Westwood Marianne
Zim Asia

Shipping Companies

Ecuadorian Line
Royal Caribbean Cruise Line

PMO Address Changes, New Telephone Numbers

Jim Saunders, PMO Baltimore, Md. is now located on the Baltimore Waterfront. His new phone number is 410-633-4709.

Pete Gibino, PMO Norfolk, VA. has also changed address. His new phone number is 757-441-3415.

Chas Henson, PMO Port Everglades, reports his area code has changed. His telephone number is now 954-463-4271.

Jim Nelson, PMO Houston, has also had a change in area code. His new telephone number is 281-534-2640.

Please see the back of this publication for current PMO mailing addresses.

PMO San Francisco, Marine Program Leader, Participate in Training Cruises

It's training season again, and the NWS is actively taking part. Bob Novak, PMO San Francisco, had the pleasure of participating in the annual training cruise aboard the California Maritime Academy training vessel Golden Bear, from April 27 - June 18, 1997. Vince Zegowitz, Marine Observations Program Leader, participated in the annual training cruise aboard the Texas Clipper, training ship of Texas A&M University.

Both Bob and Vince worked with students in the areas of basic meteorology, especially with weather observing, coding, and reporting. We expect to publish their trip reports in the future.

Errata

There is an error in NWS Observing Handbook No. 1 (August, 1995 edition), Page 2-7. The wind speed indicator, i_w, which is used to report how the wind speed measurement was made, should be coded as 3 (not as 03) when the wind speed is estimated in knots, and as 4 (not as 04), if wind speed is measured with an anemometer in knots. Our apologies for missing this one (the book was only reviewed by 30 "experts" before going to print, and no one caught it! It's a pretty obvious mistake, because there is only one column for i_w! Please refer to the Ships Code Card, which has the correct code format for i_w.⚓

National Weather Service Voluntary Observing Ship Program

New Recruits from 01-JUL-96 TO 31-MAR-97

NAME OF SHIP	CALL	AGENT NAME	RECRUITING PMO
AFFINITY	9VBW	WALLEM SHIP MANAGEMENT LTD	MIAMI, FL
ANGELA	V2WG	KERR NORTON	MIAMI, FL
ANGLIAN REEFER	ELOT8	IRGENS LARSEN A.S.	SEATTLE, WA
AOMORI WILLOW	3FIO6	UNIRAM SHIP MANAGEMENT LTD, ASIAN HOUSE	SEATTLE, WA
ARKTIS SPRING	OWVD2	BRANDTSHIPS	MIAMI, FL
ARKTIS SUN	OWOV2	BRANDTSHIP USA, INC	JACKSONVILLE, FL
ATLANTIC BULKER	3FSQ4	SHOWA LINE ENGINEERING CO_- SAKURADA BLDG.	MIAMI, FL
ATLANTIS	KAQP	WOODS HOLE OCEANO INST, ATTN RV ATLANTIS	NEW ORLEANS, LA
BANDA SEAHORSE	WCP5	TIDEWATER MARINE, INC. COOK INLET SPILL RESPONSE	ANCHORAGE, AK
BIMINI	3EEB4	MCAULIFFE MARITIME AGENCY INC	NEW YORK CITY, NY
BLUE GEMINI	3FPA6	TOKO KAIUN KAISHA LTD, TOKO BLDG	SEATTLE, WA
BLUE NOVA	3FDV6	TOKO KAIUN KAISHA, LTD	SEATTLE, WA
BUNGA SRIGADING	9MYL	MALAYSIAN INTERNATIONAL SHIPPING	SEATTLE, WA
CABO TAMAR	ELMV3	BARBER SHIP MANAGEMENT AS	SAN FRANCISCO, CA
CALIFORNIA ZEUS	ELJP8	NYK LINE N. AMERICA INC.	SEATTLE, WA
CAPE TEXAS	WSDG	APEX MARINE CORP.	NEW ORLEANS, LA
CAPE TRINITY	KAFD	APEX MARINE CORP	NEW ORLEANS, LA
CAROLA E	P3FK4	INCHCAPE SHIPPING	MIAMI, FL
CENTURY	ELQX6	CELEBRITY CRUISE LINE	MIAMI, FL
CHAITEN	ELHO7	SOUTHERN SHIP MANAGEMENT CO.	HOUSTON, TX
CHEMBULK FORTITUDE	3ESF7	MTM SHIP MANAGEMENT PTELTD	NORFOLK, VA
CHOYANG VISION	9VOQ	BARBER SHIP MANG. A/S	SEATTLE, WA
CONTSHIP FRANCE	DLDB	NSB	NORFOLK, VA
COSMOWAY	3EVO3	ICHIZAN-KINKAI KISEN, LTD	SEATTLE, WA
CRYSTAL HARMONY	C6IP2	CRYSTAL CRUISE LINE	MIAMI, FL
DAISHIN MARU	3FPS6	SHINWA MARINE CORP., INC	SEATTLE, WA
DARYA PREETH	VRUX8	KISHINCHAND CHELLARAM MARITIME	LOS ANGELES, CA
DIRCH MAERSK	OXQP2	MAERSK LINE	LOS ANGELES, CA
DREAMWARD	C6LG5	NORWEGIAN CRUISE LINE	MIAMI, FL
DUHALLOW	VRUJ9	P&O BULK SHIPPING LIMITED	BALTIMORE, MD
EAGLE BALTIMORE	9VHG	WEAVER MARINE AGENCIES, LTD	NEW YORK CITY, NY
EAGLE BOSTON	9VHI	WEAVER MARINE AGENCY	NEW YORK CITY, NY
EQUATORIAL LION	V7AS7	BRITISH PETROLEUM OIL SHIPPING	VALDEZ, AK
FANAL TRADER	VRUY4	GRIFFIN SHIPPING LTD	SEATTLE, WA
FRANCESCO	3EHN2	GESTION MARITIME S.A.M.	NEW ORLEANS, LA
FREJA JUTLANDIC	LAZY2	BILL BLACK AGENCY	NORFOLK, VA
FRONT LEADER	S6MY	NORDIC ORIENTAL SHIPMANAGEMENT PTELTD	HOUSTON, TX
GALAXY	ELTJ7	CELEBRITY CRUISE LINE	MIAMI, FL
GLOBAL NEXTAGE	XYLV	FIRST MARINE SVC CO., LTD	SEATTLE, WA
GRETKE OLDENDORFF	ELQJ7	EGON OLDENDORFF	SEATTLE, WA
HANDY ISLANDER	DXZD	ANGLO EASTERN SHIP MANG., LTD	SEATTLE, WA
HANSA CARRIER	ELTY7	INCHCAPE SHIPPING	NORFOLK, VA
HARBEL CUTLASS	D5ZA	MARINE TRANSPORT LINES	NORFOLK, VA
HOLCK LARSEN	VTFJ	LARSEN & TOUBRO LTD.	CLEVELAND, OH
HONSHU SILVIA	3EST7	UNIVAN SHIP MANG. CO. LTD	SEATTLE, WA
HUAL CARMENCITA	LAFH4	INTER OCEAN UGLAND MANAGEMENT AS	SEATTLE, WA
HYUNDAI DYNASTY	P3BA7	HYUNDAI AMERICA SHIPPING AGENT, INC	SEATTLE, WA
HYUNDAI FIDELITY	DNAG	HYUNDAI AMERICA SHIPPING AGENT	SEATTLE, WA
HYUNDAI FORTUNE	3FLG6	HYUNDAI AMERICA SHIPPING AGENT, INC	SEATTLE, WA
HYUNDAI FREEDOM	3FFS6	HYUNDAI AMERICA SHIPPING AGENT, INC	SEATTLE, WA
HYUNDAI INDEPENDENCE	3FDY6	HYUNDAI AMERICA SHIPPING	SEATTLE, WA
HYUNDAI LIBERTY	3FFT6	HYNUDAI AMERICA SHIPPING, INC	SEATTLE, WA
ICE FERN	ZCCQ2	ARMADA GREECE CO., LTD	SEATTLE, WA
ISLA DE CEDROS	3FOA6	MERIT STEAMSHIP AGENCY, INC	SEATTLE, WA
JO CLIPPER	PJNF	J. E. ASPEN SHIPPING COMPANY	BALTIMORE, MD

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New VOS Recruits

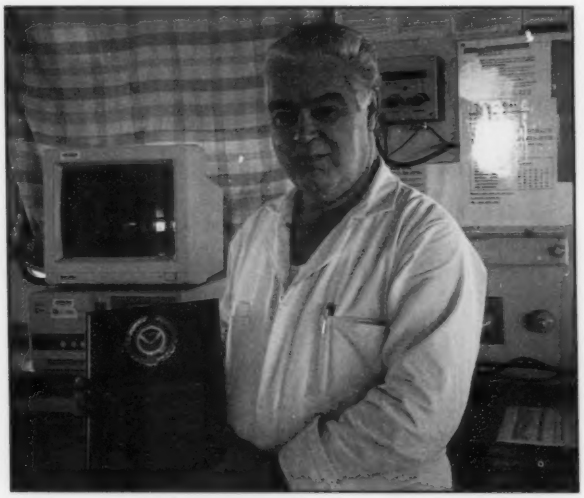
Continued from Page 60

NAME OF SHIP	CALL	AGENT NAME	RECRUITING PMO
KEN SHIN	YJQS2	INUI STEAMSHIP CO., LTD, SHINKO BLDG	SEATTLE, WA
KEN SHO	3FMS5	INUI STEAMSHIP CO., LTD, SHINKO BLDG	SEATTLE, WA
M/V TRUMP CASINO	WCW3235		CHICAGO, IL
MAERSK LA PAZ	ELQY7	MAERSK LINE	MIAMI, FL
MARINOR	C6KY9	ARKAY STEAMSHIP CORP.	BALTIMORE, MD
MARSTA MAERSK	OUNO5	GIRALDA FARMS, P.O. BOX 880	NORFOLK, VA
MARY E. HANNAH	WA3133	HANNAH MARINE	CHICAGO, IL
MUNKEBO MAERSK	OUNI5	MAERSK, INC	NEW YORK CITY, NY
NELVANA	YJW27	MARBULK SHIPPING INC	NEW YORK CITY, NY
NOBLEZA	ELDF7	WIHELMSEN LINES (USA)	BALTIMORE, MD
NORWEGIAN CROWN	C6II4	NORWEGIAN CRUISE LINE	MIAMI, FL
OCEAN CAMELLIA	3FTR6	COSMIC MARITIME CORP., IRIE BLDG	SEATTLE, WA
OCEAN HARMONY	3FRX6	MK SHIPMANAGEMENT, TORANOMON 33 MORI BLDG	SEATTLE, WA
OCEAN PEARL	3FOT2	CHO YANG SHIPPING CO., LTD, CHEOUNG-AHM BLDG.	SEATTLE, WA
OCEANIC STAR	3FPC3	DAIICHI CHUO KISEN KAISHA	SEATTLE, WA
OOCL FAME	ELRO3	OOCL (USA) INC.	SEATTLE, WA
OOCL FRONTIER	VRUC6	OOCL (USA) INC.	SEATTLE, WA
ORIENTE HOPE	3ETH4	RAINBOW MARITIME CO., LTD, KOBE YESEN BLDG.	SEATTLE, WA
PACIFIC RAINBOW II	3FCY5	OSAKA INTER. SHIPPING CO., LTDHAKUYOSHA, BLDG.,9F	SEATTLE, WA
PACROSE	YJQK2	LASCO SHIPPING CO.	SEATTLE, WA
PEARL WAVE	ELMB9	WING TAK SHIPPING AGENCY LTD	SEATTLE, WA
PINE ARROW	C6NZ3	RICE, UNRUH REYNOLDS CO	NEW YORK CITY, NY
RUBIN PEARL	YJQA8	SATO STEAMSHIP CO., LTD	SEATTLE, WA
RUBIN PROSPER	DUCE	NAVIX LINE LTD	SEATTLE, WA
SANTA CHRISTINA	3FAE6	NISSHO SHIPPING CO., LTD, NO.33 MORI BLDG	SEATTLE, WA
SANTA ROSA	LANM4	IVARAN AGENCIES INC.	NORFOLK, VA
SAPPHIRE	DUJW	ANGLO - EASTERN SHIP MANAGEMENT LTD.	NEW YORK CITY, NY
SC HORIZON	ELOC8	WEAVER MARINE AGENCIES LTD.	NEW YORK CITY, NY
SEA WISDOM	3FUO6	KYOKUTO SHIPPING CO., MITSUI BLDG NO. 3	SEATTLE, WA
SEAWIND CROWN	3EIY6	SEAWIND CRUISE LINE	MIAMI, FL
SERIFE	TCML	GEDEN LINES	SEATTLE, WA
SINGA STAR	9VNF	SINGA STAR PTE, LTD	SEATTLE, WA
SONG OF AMERICA	LENA3	ROYAL CARIBBEAN CRUISES LTD	MIAMI, FL
SOUTH FORTUNE	3FJC6	WORLD MARINE CO., LTD, KANPAI BLDG 8 FLR	SEATTLE, WA
SPRING WAVE	9VXB	ORIX MARITIME CORP., LTD	SEATTLE, WA
STAR HANSA	LAXP4	A. S. BILLABONG, C. SUNDTSGT. 17-19	JACKSONVILLE, FL
STAR HARDANGER	LAXD4	WESTFAL-LARSEN MANAGEMENT A/S	BALTIMORE, MD
STAR HOYANGER	LAXG4	STAR SHIPPING INC.	LOS ANGELES, CA
STAR PRINCESS	ELIR8	PRINCES CRUISES	MIAMI, FL
STATENDAM	PHSG	ELLER AND CO.	MIAMI, FL
STELLA SOLARIS	SYWT	SUN LINE CRUISES	MIAMI, FL
SUN DANCE	3ETQ8	ORIENT LINE CO., LTD	SEATTLE, WA
SUN PRINCESS	ELSJ2	PRINCESS CRUISES	MIAMI, FL
TAIKO	LAQT4	WILHELMSEN LINES (USA) INC.	NEW YORK CITY, NY
TARONGA	LACU5	WILHELMSEN LINES (USA) INC.	JACKSONVILLE, FL
THORKIL MAERSK	MSJX8	UNIVERSAL MARITIME	MIAMI, FL
THORNHILL	YJZU9	BARBER SHIP MGMT LTD	NEW ORLEANS, LA
TK GLORIA	3FQI4	OVERSEAS ENTERPRISES INC	NEW YORK CITY, NY
TORM AMERICA	J8FI5	KERR-NORTON MARINE AGENCIES	NEW YORK CITY, NY
TUNDRA KING	ELNU5	ECUADORIAN LINE, INC	NEW YORK CITY, NY
USCGC ADAK	NZRW	COMMANDING OFFICER, USCGC ADAK (WPB 1333)	NEW YORK CITY, NY
USCGC VENTUROUS WMEC 625	NVES	COMMANDING OFFICER	SAN FRANCISCO, CA
USNS ASSERTIVE	NAFY	COMMANDING OFFICER	LOS ANGELES, CA
USNS BOWDITCH	NWSW	COMMANDING OFFICER	NEW ORLEANS, LA
USNS GORDON	NAKL	BAY SHIP MGMT.	NORFOLK, VA
USNS SHUGHART	NOAQ	BAY SHIP MANAGEMENT	NORFOLK, VA
VEENDAM	C6NL6	HOLLAND AMERICA CRUISES	MIAMI, FL
VISAYAN GLORY	3EHJ7	TOKUMARU KAIUN CO., LTD, SAITO BLDG	SEATTLE, WA
ZIM ASIA	4XFB	ZIM AMERICAN SHIPPING	MIAMI, FL
ZIM SANTOS	ELRJ6	ZIM AMERICAN SHIPPING CO.	BALTIMORE, MD

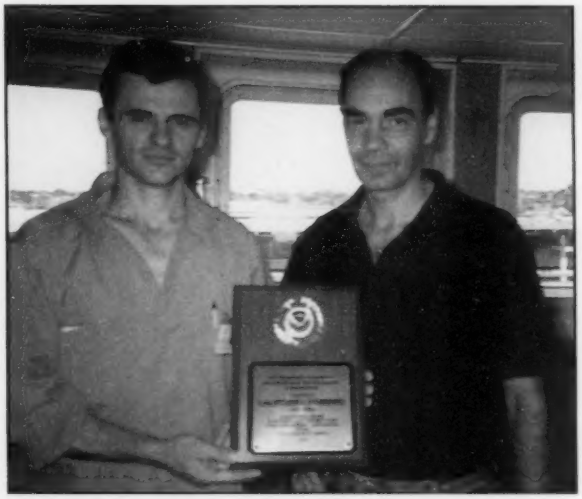
PMO George Smith of Cleveland presented a VOS award to the SS Kinsman Independent. *Pictured from left to right are 2nd Mate Alan Gwyn, Captain Virgil Hurley, and 1st Mate Danny Brink. Not pictured was 3rd Mate Kevin Finch.*

George Smith, PMO Cleveland (right) presents a VOS award to Captain Bobby Tilley of the M/V Courtney Burton.

The cruise ship S/S Norway, *one of the Norwegian Cruise Line ships, was presented a 1995 VOS award. Pictured left to right are Hakon Giangdal, Captain of the Norway, and Jam Ottesen, Norway Staff Captain.*



Captain Mavro Capitani of the Western Lion *displays a VOS award presented to him by Bob Webster, PMO in Los Angeles. The tanker operates between Valdez, Alaska and St. Croix in the Virgin Islands. In addition to taking meteorological observations, the Western Lion participates in the NOAA XBT program.*



PMO Jack Warrelmann of New Orleans presented a 1995 Ship Award to California Current. *Pictured are C/O Mirko Bosanac (left) and Capt. Milorad Petrovic (right).*

Seattle PMO Pat Brandow presented a VOS award to the M/V Gyn Yoh. *From left to right are 2/Mate Luis Seromines, Capt. Leon G. Edralin, and R/O Restituto V. Gargarita, Jr.*

New Orleans PMO Jack Warrelmann presented a VOS award to the Gulf Current. *Pictured left to right are Master Babic Nikola, C/O Brezac Marino, PMO Jack Warrelmann, and 2/O Dobrila Bojan.*

Norfolk PMO Pete Gibino presents a VOS award to Captain Nelson Moraes for the ship D.G. Columbia *in recognition of consistency, quality, and large numbers of observations.*

Great Lakes Wrecks—Emperor

Skip Gillham

It will be fifty years ago next June that the big Canadian bulk carrier EMPEROR sank on Lake Superior. She was lost on the rocks off Isle Royale at the western end of the lake.It was an accident that should not have happened.

The vessel was built by the famous Collingwood Shipbuilding Company in the picturesque community nestled along the shore of Georgian Bay. Construction took place during 1910, but the December 17 launch was too late for that shipping season. Winter work had EMPEROR ready for 1911 and she entered service May 3 for Inland Lines.

At 525 feet in overall length, this was one of the biggest freighters on the Great Lakes in an era still influenced by wooden hulled steamers and sailing schooners. A 2,200 horsepower triple expansion engine gave a service speed of 10 knots and the ship could carry in the range of 10,000 tons of cargo. EMPEROR had five cargo holds and these were accessed by 30 hatches. These had telescopic covers and EMPEROR was the first Canadian ship so equipped. Wooden slats covered by tarpaulins had been the most common protection to this point.

When Canada Steamship Lines was organized, through the merger of a number of smaller fleets in 1913, EMPEROR became the biggest boat in the biggest Canadian inland fleet. Too large to travel to Lake Ontario, her early years were spent hauling ore, coal, and grain on the four upper Great Lakes. She often delivered iron ore to Point Edward for rail transfer to the steel mill at Hamilton. The first trip down the new and enlarged Welland Canal on July 6, 1931, opened Lake Ontario to ships of this size and allowed for direct delivery to the steelmaker and grain elevators.

Her last cargo came aboard at the Canadian grain terminal of Port

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Great Lakes Wrecks—Emperor

Continued from Page 64

Arthur (now Thunder Bay). She departed in clear, pleasant spring weather, but at about 0410 hours, June 4, 1947, EMPEROR slammed into the rocks after traveling only 45 miles.

The force of the collision caused the hull to crack and the stern soon slipped back into deep water. Prior to going down, the starboard lifeboat was lowered safely, but the port one overturned. Twelve sailors, including Capt. Eldon Walkinshaw, perished but 21 were rescued.

Fortunately, the USCG KIMBALL was in the vicinity and responded to the distress call. She hurried to the scene and ten sailors were picked up from the starboard boat. Seven more, who were clinging to nearby rocks, were saved, as were four hanging on to the overturned port lifeboat.

An investigation noted EMPEROR was two miles off course when she hit and none of the men on watch at the time survived.

The bow section soon slipped off the perch into deep water, although the top of the pilothouse remained above the surface and visible for several months.

Today EMPEROR is a popular attraction for scuba divers. The bow is now in about 35 feet of water and slopes off to 150 feet at the stern.⚓

Photo Credit: Taylor Photo

VOS Cooperative Ship Reports — 2nd and 3rd Quarters 1996

The National Climatic Data Center compiles the tables for the VOS Cooperative Ship Report from radio messages and weather logs. The three columns under the heading "MANUSCRIPT RECEIVED" denote whether or not a form was received for that month (Y/N). Forms are considered late (L) if they arrive more than 60 days after the data month. Some ships may show 100% radio observations but show forms were also received. This occurs when the mail and radio observations are duplicated. The observation count does not reflect duplicates.

Port Meteorological Officers supply ship names to the NCDC. Comments or questions regarding this report should be directed to NCDC, Operations Support Division, 151 Patton Avenue, Asheville, NC 28801 Attn: Dimitri Chappas (704-271-4437 or dchappas@ncdc.noaa.gov).

NAME	TOTAL OBS	PERCENT VIA RADIO	MANUSCRIPT RECEIVED APR	MAY	JUN
1ST LT BALDOMERO LOPEZ	82	100.0	N	N	N
1ST LT JACK LUMMUS	78	17.9	Y	N	N
2ND LT. JOHN P. BOBO	100	99.0	Y	Y	Y
A. V. KASTNER	56	100.0	N	N	N
ABBEY	119	100.0	N	N	N
ABITIBI ORINOCO	46	100.0	N	N	N
ACACIA	52	75.0	Y	Y	N
ACADIA FOREST	154	37.0	Y	Y	Y
ACT 7	202	100.0	N	N	N
ACT I	129	100.0	N	N	N
ADABELLE LYKES	55	32.7	Y	N	N
ADAM E. CORNELIUS	74	63.5	Y	Y	Y
ADDIRIYAH	53	0.0	Y	Y	Y
ADVANTAGE	67	37.3	Y	Y	Y
AFFINITY	4	100.0	N	N	N
AGDLEK	41	100.0	N	N	N
AGPA	22	100.0	N	N	N
AGULHAS	145	72.4	Y	Y	N
AL AWDAH	33	100.0	N	N	N
AL FUNTAS	155	100.0	N	N	N
AL SAMIDOON	139	100.0	N	N	N
AL SHUHADAA	151	100.0	N	N	N
AL TAHREER	19	100.0	N	N	N
AL WATTAYAH	33	100.0	N	N	N
ALAM SELARAS	6	100.0	N	N	N
ALASKA	33	93.9	Y	Y	N
ALBATROS	11	100.0	N	N	N
ALBEMARLE ISLAND	70	92.8	Y	Y	N
ALBERNI DAWN	160	100.0	N	N	N
ALDEN W. CLAUSEN	179	18.4	Y	Y	Y
ALLIGATOR AMERICA	84	100.0	N	N	N
ALLIGATOR BRAVERY	128	89.8	Y	Y	Y
ALLIGATOR COLUMBUS	87	90.8	Y	Y	Y
ALLIGATOR GLORY	56	73.2	Y	Y	Y
ALLIGATOR LIBERTY	180	100.0	N	N	N
ALLIGATOR STRENGTH	171	50.2	Y	Y	Y
ALLIGATOR VICTORY	30	70.0	Y	Y	Y
ALMANIA	32	75.0	Y	Y	Y
ALMERIA LYKES	104	25.9	Y	Y	Y
ALPENA	85	85.8	N	N	L
ALPHA HELIX	86	94.1	Y	Y	N
ALTAMONTE	23	100.0	N	N	N
AMALIA	165	15.7	Y	Y	Y
AMAZON	125	95.2	Y	Y	Y
AMBASSADOR	54	94.4	Y	Y	Y
AMBASSADOR BRIDGE	55	89.0	Y	Y	Y
AMER HIMALAYA	42	100.0	N	N	N
AMERICA STAR	177	100.0	N	N	N
AMERICAN CONDOR	128	44.5	Y	Y	Y
AMERICAN CORMORANT	5	100.0	N	N	N
AMERICAN FALCON	34	100.0	N	N	N
AMERICAN OSPREY	44	100.0	N	N	N
AMERICANA	49	97.9	Y	Y	Y
AMERIGO VESPUCCI	52	65.3	Y	Y	N
ANASTASIS	22	100.0	N	N	N
ANATOLIY KOLESNICHENKO	9	100.0	N	N	N
ANDERS MAERSK	209	49.2	Y	Y	Y
ANDES CHALLENGER	11	100.0	N	N	N
ANNA MAERSK	136	81.6	Y	Y	Y
APL CHINA	158	91.1	Y	Y	N
APL JAPAN	91	89.0	Y	Y	Y
APL KOREA	114	86.8	Y	Y	Y
APL PHILIPPINES	125	0.0	Y	Y	Y
APL SINGAPORE	46	91.3	N	N	L
AQIPIITTUK	11	100.0	N	N	N
ARABELLA	170	22.3	Y	Y	Y
ARABIAN SEA	39	71.7	Y	Y	N
ARABIAN SENATOR	29	100.0	N	N	N
ARCO ALASKA	29	3.4	Y	Y	N
ARCO CALIFORNIA	70	7.1	Y	Y	N
ARCO FAIRBANKS	47	89.3	Y	Y	Y
ARCO INDEPENDENCE	46	10.8	Y	Y	Y
ARCO SAG RIVER	1	100.0	N	N	N
ARCO SPIRIT	25	84.0	N	N	L
ARCO TEXAS	58	44.8	Y	Y	Y
ARCTIC OCEAN	59	61.0	Y	Y	N
ARCTIC SUN	145	23.4	Y	Y	Y
ARCTIC UNIVERSAL	176	100.0	N	N	N
ARDMORE	23	100.0	N	N	N
ARGONAUT	126	34.9	Y	Y	Y
ARIES	13	100.0	N	N	N
ARINA ARCTICA	140	100.0	N	N	N
ARKONA	83	100.0	N	N	N
ARKTIS LIGHT	136	94.8	Y	Y	N

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NAME	TOTAL OBS	PERCENT VIA RADIO	MANUSCRIPT RECEIVED APR	MAY	JUN
ARMCO	55	85.4	Y	Y	Y
ARTHUR M. ANDERSON	208	87.5	Y	Y	Y
ARTHUR MAERSK	194	76.8	Y	N	N
ASIAN CHALLENGER	25	100.0	N	N	N
ASIAN SENATOR	42	100.0	N	N	N
ASIMONT	58	100.0	N	N	N
ATLANTA BAY	77	100.0	N	N	N
ATLANTIC	657	100.0	N	N	N
ATLANTIC COMPANION	72	100.0	N	N	N
ATLANTIC COMPASS	95	100.0	N	N	N
ATLANTIC CONCERT	72	100.0	N	N	N
ATLANTIC CONVEYOR	31	100.0	N	N	N
ATLANTIC ERIE	1	100.0	N	N	N
ATLANTIC HURON	162	100.0	N	N	N
ATLANTIC OCEAN	23	100.0	Y	Y	Y
ATLANTIC SUPERIOR	128	100.0	N	N	N
AUCKLAND STAR	67	100.0	N	N	N
AUSTRAL RAINBOW	32	25.0	Y	Y	N
AUTHOR	120	100.0	N	N	N
AXEL MAERSK	154	74.6	Y	Y	Y
B.T. ALASKA	48	52.0	Y	Y	Y
BACO-LINER 1	112	100.0	N	N	N
BACO-LINER 2	128	100.0	N	N	N
BACO-LINER 3	107	100.0	N	N	N
BAR' ZAN	46	100.0	N	N	N
BARBARA ANDRIE	110	73.6	Y	Y	N
BARBICAN SPIRIT	94	100.0	N	N	N
BARRINGTON ISLAND	63	100.0	N	N	N
BAUCHI	88	86.3	Y	Y	Y
BAY BRIDGE	129	10.8	N	N	L
BELGRANO	25	76.0	N	N	L
BERING SEA	173	90.7	Y	Y	Y
BERNARDO QUINTANA A	189	93.1	Y	Y	Y
BESKYTTEREN	7	100.0	N	N	N
BLIKUR	21	100.0	N	N	N
BLUE RIDGE	33	93.9	Y	Y	N
BOGASARI LIMA	3	100.0	N	N	N
BOHINJ	227	13.6	Y	Y	Y
BONN EXPRESS	102	100.0	N	N	N
BOSPORUS BRIDGE	115	100.0	N	N	N
BOW TRIGGER	167	90.4	Y	Y	N
BP ADMIRAL	85	100.0	N	N	N
BREMEN EXPRESS	3	100.0	N	N	N
BRIGHT PHOENIX	161	91.3	N	N	N
BRIGIT MAERSK	21	71.4	N	N	N
BRISBANE STAR	220	100.0	N	N	N
BRITISH ADVENTURE	76	100.0	N	N	N
BRITISH RANGER	197	100.0	N	N	N
BROOKLYN BRIDGE	191	99.4	Y	Y	Y
BRUCE SMART	225	7.1	Y	Y	Y
BT NIMROD	150	100.0	N	N	N
BUCKEYE	219	60.7	Y	Y	Y
BUFFALO SOLDIER	50	56.0	Y	N	N
BUNGA KESIDANG	7	100.0	N	N	N
BUNGA ORKID DUA	2	100.0	N	N	N
BUNGA PELANGI DUA	33	100.0	N	N	N
BUNGA SAGA TIGA	99	65.6	Y	Y	Y
BUNGA SURIA	14	100.0	N	N	N
BURNS HARBOR	400	86.0	Y	Y	Y
BURSA	10	100.0	N	N	N
BUX SEA	31	100.0	N	N	N
CALCITE II	94	88.2	N	N	L
CALIFORNIA CURRENT	129	100.0	N	N	N
CALIFORNIA HERMES	232	6.0	Y	Y	Y
CALIFORNIA LUNA	90	100.0	N	N	N
CALIFORNIA MERCURY	159	100.0	N	N	N
CALIFORNIA ORION	149	57.7	Y	Y	Y
CALIFORNIA PEGASUS	77	100.0	N	N	N
CALIFORNIA SATURN	53	83.0	Y	Y	Y
CALIFORNIA TRITON	115	62.6	Y	Y	Y
CALIFORNIA ZEUS	53	100.0	N	N	N
CANADIAN LIBERTY	3	100.0	N	N	N
CAPE BREEZE	163	92.0	N	N	L
CAPE CHARLES	51	100.0	N	N	N
CAPE HENRY	44	100.0	N	N	N
CAPE INTREPID	94	31.9	Y	N	N
CAPE MAY	124	100.0	N	N	N
CARIBBEAN MERCY	8	100.0	Y	N	N
CARLA A. HILLS	115	90.4	Y	N	N
CARMEL	14	100.0	N	N	N
CASON J. CALLAWAY	191	70.6	Y	Y	Y
CCNI ATACAMA	64	78.1	Y	Y	Y
CELEBRATION	73	95.8	Y	Y	Y
CELTIC SEA	91	43.9	Y	Y	Y
CENTURY HIGHWAY #2	6	100.0	N	N	N
CENTURY HIGHWAY NO. 1	9	100.0	N	N	N
CENTURY HIGHWAY NO. 5	36	100.0	N	N	N
CENTURY HIGHWAY_NO. 3	68	100.0	N	N	N
CENTURY LEADER NO. 1	47	100.0	N	N	N
CGM PROVENCE	92	100.0	N	N	N
CHAITEN	9	100.0	N	N	N
CHARLES ISLAND	88	95.4	Y	Y	Y
CHARLES LYKES	92	100.0	N	N	N
CHARLES M. BEEGHLEY	43	86.0	Y	N	N
CHASTINE MAERSK	163	59.5	Y	Y	Y
CHC NO.1	27	100.0	N	N	N
CHEMICAL PIONEER	44	77.2	Y	N	N
CHEMICAL RUBI	28	100.0	N	N	N
CHESAPEAKE TRADER	77	31.1	Y	Y	N
CHEVRON ARIZONA	50	48.0	Y	Y	Y
CHEVRON COLORADO	66	96.9	N	N	L
CHEVRON EDINBURGH	225	47.1	Y	Y	Y
CHEVRON EMPLOYEE PRIDE	146	11.6	Y	Y	N
CHEVRON FELUY	122	0.0	Y	N	N
CHEVRON MARINER	244	0.0	Y	Y	Y
CHEVRON MISSISSIPPI	92	94.5	Y	Y	Y
CHEVRON PACIFIC	177	42.9	Y	Y	Y
CHEVRON PERTH	1	100.0	N	N	N
CHEVRON SOUTH AMERICA	38	44.7	N	N	L
CHEVRON WASHINGTON	38	52.6	Y	N	N
CHIEF GADAO	111	67.5	Y	Y	Y
CHILEAN EXPRESS	25	100.0	N	N	N
CHILEAN REEFER	36	100.0	N	N	N
CHINA HOPE	53	100.0	N	N	N
CHINA SPIRIT	13	100.0	N	N	N
CHIQUITA BARACOA	232	100.0	N	N	N
CHIQUITA BARU	308	100.0	N	N	N
CHIQUITA BELGIE	164	100.0	N	N	N
CHIQUITA BREMEN	5	100.0	N	N	N
CHIQUITA BRENDA	197	100.0	N	N	N
CHIQUITA DEUTSCHLAND	156	100.0	N	N	N
CHIQUITA ELKESCHLAND	156	100.0	N	N	N
CHIQUITA FRANCES	160	100.0	N	N	N
CHIQUITA ITALIA	146	100.0	N	N	N
CHIQUITA JEAN	160	100.0	N	N	N
CHIQUITA JOY	114	100.0	N	N	N
CHIQUITA NEDERLAND	154	100.0	N	N	N
CHIQUITA ROSTOCK	133	100.0	N	N	N
CHIQUITA SCANDINAVIA	167	100.0	N	N	N
CHIQUITA SCHWEIZ	149	100.0	N	N	N
CHOAPA	137	90.5	N	N	L
CHOYANG PRIDE	53	100.0	N	N	N

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NAME	TOTAL OBS	PERCENT VIA RADIO	MANUSCRIPT RECEIVED APR	MAY	JUN
CHRISTIANE	116	81.8	Y	Y	Y
CHUN HO	115	26.9	Y	Y	Y
CITY OF DURBAN	140	100.0	N	N	N
CLEVELAND	134	6.7	N	N	L
CLIFFORD MAERSK	93	69.8	Y	Y	Y
CMS ISLAND EXPRESS	75	0.0	Y	Y	Y
COAST RANGE	44	90.9	Y	N	N
COLUMBIA BAY	87	100.0	N	N	N
COLUMBIA STAR	306	92.8	N	N	L
COLUMBINE	226	76.9	Y	Y	Y
COLUMBUS AMERICA	32	100.0	N	N	N
COLUMBUS CALIFORNIA	123	100.0	N	N	N
COLUMBUS CANADA	196	100.0	N	N	N
COLUMBUS OLIVOS	144	25.6	Y	Y	Y
COLUMBUS QUEENSLAND	173	100.0	N	N	N
COLUMBUS VICTORIA	111	100.0	N	N	N
CONDOLEEZZA RICE	39	0.0	Y	N	N
CONTIENTAL WING	70	100.0	N	N	N
CONTSHIP ENGLAND	15	100.0	N	N	N
CONTSHIP FRANCE	2	100.0	N	N	N
CONTSHIP HOUSTON	135	100.0	N	N	N
COPACABANA	77	0.0	Y	Y	N
CORAL HIGHWAY	109	100.0	N	N	N
CORMORANT ARROW	83	61.4	Y	Y	Y
CORNELIA MAERSK	20	0.0	N	N	L
CORNUCOPIA	77	67.5	Y	Y	Y
CORPUS CHRISTI	15	100.0	N	N	N
CORWITH CRAMER	13	46.1	Y	N	N
COSMIC CHALLENGER	178	43.2	Y	Y	Y
COSMIC MASTER	154	96.7	Y	Y	Y
COURAGEOUS	65	0.0	Y	Y	N
COURIER	91	74.7	Y	Y	N
COURTNEY BURTON	162	82.0	Y	Y	Y
COURTNEY L	187	62.0	Y	Y	Y
CRANE PACIFIC	92	84.7	Y	Y	Y
CRISTOFORO COLOMBO	34	79.4	Y	N	N
CROWN OF SCANDINAVIA	266	100.0	N	N	N
CROWN PRINCESS	3	100.0	N	N	N
CSK UNITY	70	85.7	Y	Y	Y
CSL ATLAS	67	100.0	N	N	N
CSL CABO	62	12.9	Y	N	N
CSS HUDSON	109	100.0	N	N	N
CTE ALGECIRAS	3	100.0	N	N	N
DAN MOORE	3	100.0	N	N	N
DANIA PORTLAND	130	100.0	N	N	N
DAVID Z. NORTON	55	83.6	Y	Y	Y
DEL MONTE CONSUMER	85	0.0	Y	Y	Y
DEL MONTE PACKER	74	100.0	Y	Y	N
DEL MONTE TRADER	43	81.3	Y	N	N
DELAWARE TRADER	303	99.0	Y	Y	N
DELMONTE PLANTER	86	93.0	Y	Y	Y
DELMONTE TRANSPORTER	27	92.5	Y	N	N
DENALI	97	100.0	N	N	N
DEPPE FLORIDA	185	100.0	N	N	N
DG COLUMBIA	279	67.3	Y	Y	Y
DIAMOND STAR	17	100.0	N	N	N
DIRECT EAGLE	93	100.0	N	N	N
DIRECT FALCON	183	80.3	Y	Y	Y
DIRECT KEA	123	100.0	N	N	N
DIRECT KIWI	213	100.0	Y	Y	Y
DIRECT KOOKABURRA	98	43.8	N	N	L
DOCK EXPRESS 10	160	100.0	N	N	N
DOCK EXPRESS 20	62	100.0	N	N	N
DOCTOR LYKES	171	1.7	Y	Y	Y
DODGE ISLAND	4	0.0	N	N	L
DOLE COSTA RICA	33	48.4	Y	Y	N
DOLPHIN IV	1	100.0	N	N	N
DOROTHEA OLDENDORFF	156	28.2	Y	Y	Y
DORTHE OLDENDORFF	105	67.6	Y	Y	Y
DOUBLE GLORY	141	83.6	Y	Y	Y
DRYSO	171	53.2	Y	Y	N
DSR BALTIC	76	100.0	N	N	N
DSR EUROPE	69	100.0	N	N	N
DSR PACIFIC	109	100.0	N	N	N
DUBROVNIK EXPRESS	14	100.0	N	N	N
DUCHESS	38	78.9	Y	Y	N
DUNCAN ISLAND	188	82.9	Y	Y	Y
DUSSELDORF EXPRESS	6	100.0	N	N	N
E.P. LE QUEBECOIS	458	100.0	N	N	N
EARL W. OGLEBAY	26	57.6	N	N	L
EASTERN LION	138	100.0	N	N	N
ECSTASY	6	100.0	N	N	N
EDELWIESS	105	65.7	N	N	L
EDGAR B. SPEER	170	94.7	Y	Y	Y
EDWIN H. GOTT	300	88.3	Y	Y	Y
EDYTH L	129	95.3	Y	Y	N
ELENORE	7	100.0	N	N	N
ELISE SHULTE	85	0.0	Y	Y	Y
ELLEN KNUDSEN	18	94.4	Y	Y	N
ELLENSBORG	138	0.0	Y	Y	Y
ELLIOTT BAY	192	91.6	Y	Y	Y
ELSBERG	262	20.9	Y	Y	Y
EMPIRE STATE	47	100.0	N	N	N
ENIF	105	100.0	N	N	N
EVER GAINING	13	100.0	N	N	N
EVER GARLAND	5	100.0	N	N	N
EVER GATHER	13	100.0	N	N	N
EVER GENTLE	4	100.0	N	N	N
EVER GENTRY	11	100.0	N	N	N
EVER GIVEN	11	100.0	N	N	N
EVER GLAMOUR	15	100.0	N	N	N
EVER GLEAMY	8	100.0	N	N	N
EVER GLOBE	5	100.0	N	N	N
EVER GOING	16	100.0	N	N	N
EVER GOLDEN	12	100.0	N	N	N
EVER GOVERN	6	100.0	N	N	N
EVER GRADE	2	100.0	N	N	N
EVER GROWTH	16	75.0	Y	N	N
EVER GUARD	7	100.0	N	N	N
EVER LOADING	18	100.0	N	N	N
EVER RACER	6	100.0	N	N	N
EVER REFINE	15	93.3	N	N	L
EVER RESULT	54	74.0	Y	Y	N
EVER RIGHT	23	95.6	N	N	L
EVER ROUND	46	58.6	Y	N	N
EWL VENEZUELA	599	100.0	N	N	N
EXCELSIOR	196	100.0	N	N	N
EXEMPLAR	244	100.0	N	N	N
EXPORT FREEDOM	138	39.8	Y	Y	Y
EXPORT PATRIOT	160	23.7	Y	Y	Y
FAIRLIFT	135	100.0	N	N	N
FALSTER	27	100.0	N	N	N
FALSTRIA	144	100.0	N	N	N
FANTASY	24	4.1	Y	Y	Y
FARALLON ISLAND	257	100.0	N	N	N
FASCINATION	48	95.8	Y	Y	N
FAUST	112	47.3	Y	Y	Y
FERNCROFT	97	87.6	Y	Y	N
FETISH	139	100.0	N	N	N
FIDELIO	67	73.1	Y	N	N
FIGARO	29	89.6	N	N	L
FIORA TOPIC	3	100.0	N	N	N

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NAME	TOTAL OBS	PERCENT VIA RADIO	MANUSCRIPT RECEIVED APR	MAY	JUN
FIR GROVE	371	6.1	Y	Y	Y
FLAMENGO	116	69.8	Y	N	N
FLORAL LAKE	9	100.0	N	N	N
FOREST CHAMPION	27	100.0	N	N	N
FRANCES HAMMER	71	100.0	N	N	N
FRANCES L	96	87.5	Y	Y	Y
FRED R. WHITE JR	90	72.2	Y	Y	Y
FREJA SVEA	9	88.8	Y	N	N
FULL COMFORT	274	77.7	Y	Y	Y
GALVESTON BAY	179	46.9	N	N	L
GENEVIEVE LYKES	14	100.0	N	N	N
GEORGE A. SLOAN	236	91.1	Y	Y	Y
GEORGE A. STINSON	44	100.0	Y	Y	N
GEORGE H. WEYERHAEUSER	132	84.0	Y	Y	Y
GEORGE SCHULTZ	58	58.6	Y	Y	N
GEORGE WASHINGTON BRID	243	98.3	Y	Y	Y
GEORGIA RAINBOW II	202	100.0	N	N	N
GERMAN SENATOR	151	100.0	N	N	N
GERONIMO	22	68.1	N	N	L
GINGA MARU	62	100.0	N	N	N
GLOBAL LINK	30	100.0	N	N	N
GLOBAL MARINER	30	53.3	Y	N	N
GLOBAL SENTINEL	75	100.0	N	N	N
GLORIOUS SUN	183	89.0	Y	Y	Y
GOLDEN APO	44	100.0	N	N	N
GOLDEN BEAR	92	100.0	N	N	N
GOLDEN GATE	120	52.5	Y	Y	N
GOLDEN GATE BRIDGE	157	99.3	N	N	L
GOPHER STATE	26	100.0	N	N	N
GREAT LAKE	18	100.0	N	N	N
GREAT LAND	20	85.0	N	N	L
GREEN BAY	181	40.3	Y	Y	Y
GREEN HARBOUR	113	25.6	N	N	L
GREEN ISLAND	87	41.3	N	N	L
GREEN LAKE	138	38.4	N	N	L
GREEN MAYA	36	100.0	N	N	N
GREEN RAINIER	3	100.0	N	N	N
GREEN RIDGE	150	28.6	Y	Y	Y
GREEN SASEBO	29	68.9	Y	N	N
GREEN SUMA	3	100.0	N	N	N
GREEN VALLEY	92	25.0	Y	Y	N
GROTON	136	96.3	Y	Y	Y
GROWTH RING	97	100.0	N	N	N
GUANAJUATO	53	100.0	N	N	N
GUAYAMA	115	72.1	Y	Y	Y
GULF CURRENT	268	7.0	Y	Y	N
GULF SPIRIT	19	100.0	N	N	N
GULL ARROW	32	100.0	N	N	N
GYN YOH	31	100.0	N	N	N
GYPSUM BARON	115	100.0	N	N	N
GYPSUM KING	87	100.0	N	N	N
H. LEE WHITE	3	0.0	N	N	L
HAKONE MARU	21	100.0	N	N	N
HANDY BRAVE	140	1.4	Y	Y	Y
HANDY LOGGER	93	88.1	Y	Y	N
HANJIN BARCELONA	37	100.0	N	N	N
HANJIN BREMEN	24	58.3	Y	Y	N
HANJIN COLOMBO	39	100.0	N	N	N
HANJIN ELIZABETH	5	100.0	N	N	N
HANJIN HONG KONG	51	100.0	N	N	N
HANJIN KAOHSIUNG	10	100.0	N	N	N
HANJIN KEELUNG	7	100.0	N	N	N
HANJIN KOBE	11	100.0	N	N	N
HANJIN LE HAVRE	5	100.0	N	N	N
HANJIN MARSEILLES	33	100.0	N	N	N
HANJIN OAKLAND	8	100.0	N	N	N
HANJIN PORTLAND	29	79.3	N	N	L
HANJIN ROTTERDAM	15	100.0	N	N	N
HANJIN SHANGHAI	34	100.0	N	N	N
HANJIN SINGAPORE	10	100.0	N	N	N
HANJIN TOKYO	51	80.3	Y	Y	N
HANJIN VANCOUVER	5	100.0	N	N	N
HANSA LUBECK	62	100.0	N	N	N
HARBOUR BRIDGE	164	45.1	Y	Y	Y
HAVELLAND	13	100.0	N	N	N
HEICON	109	39.4	Y	Y	N
HEIDELBERG EXPRESS	903	100.0	N	N	N
HELVETIA	82	100.0	Y	Y	N
HENRY HUDSON BRIDGE	236	100.0	N	N	N
HERBERT C. JACKSON	91	81.3	Y	Y	Y
HESIOD	200	100.0	N	N	N
HG-7 NIELS JENSEN	132	100.0	N	N	N
HOEGH CAIRN	14	100.0	N	N	N
HOEGH CLIPPER	17	100.0	N	N	N
HOEGH DRAKE	53	69.8	Y	N	N
HOEGH DUKE	24	45.8	N	N	L
HOEGH DYKE	35	40.0	Y	N	N
HOEGH MERIT	152	51.9	Y	Y	Y
HOEGH MINERVA	95	29.4	Y	Y	N
HOLCK LARSEN	1	100.0	N	N	N
HOOD ISLAND	77	100.0	N	N	N
HORIZON	117	39.3	Y	N	N
HOUSTON EXPRESS	143	100.0	N	N	N
HOWELL LYKES	101	30.6	Y	Y	Y
HUAL INGRITA	17	100.0	N	N	N
HUAL KARINITA	26	100.0	N	N	N
HUAL ROLITA	31	0.0	N	N	L
HUMACAO	227	52.8	Y	Y	Y
HVIDBJORNEN	72	100.0	N	N	N
HYUNDAI DUKE	34	100.0	N	N	N
HYUNDAI EMPEROR	17	100.0	N	N	N
HYUNDAI LONGVIEW	136	94.1	N	N	L
HYUNDAI PORTLAND	36	100.0	N	N	N
HYUNDAI TACOMA	149	90.6	Y	Y	Y
IGARKA	36	100.0	N	N	N
IMAGINATION	99	88.8	Y	Y	Y
INDIAN OCEAN	60	95.0	Y	Y	N
INDIANA HARBOR	162	65.4	N	N	L
INGER-C	146	81.5	Y	Y	N
INLAND SEAS	14	42.8	N	N	L
INSPIRATION	139	42.4	Y	Y	Y
IOWA TRADER	115	54.7	Y	Y	Y
IRENA ARCTICA	346	100.0	N	N	N
ISLA GRAN MALVINA	19	100.0	N	N	N
ISLAND BREEZE	23	56.5	Y	N	N
ISLAND PRINCESS	5	100.0	N	N	N
ITB BALTIMORE	92	68.4	Y	Y	Y
ITB MOBILE	125	73.6	Y	Y	Y
ITB NEW YORK	96	51.0	Y	Y	Y
IVER EXPLORER	91	100.0	N	N	N
IVER EXPRESS	78	100.0	N	N	N
IWANUMA MARU	238	24.7	Y	Y	Y
J. DENNIS BONNEY	66	33.3	Y	N	N
JACKSONVILLE	185	91.8	Y	Y	Y
JADE ORIENT	4	100.0	N	N	N
JADE PACIFIC	24	100.0	N	N	N
JAHRE SPIRIT	36	100.0	N	N	N
JALAGOVIND	3	100.0	N	N	N
JAMES LYKES	79	100.0	N	N	N
JAMES R. BARKER	101	90.0	N	N	L
JAPAN RAINBOW 2	144	45.1	Y	Y	N
JAPAN SENATOR	38	100.0	N	N	N

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NAME	TOTAL OBS	PERCENT VIA RADIO	MANUSCRIPT RECEIVED APR	MAY	JUN
JASMINE	194	100.0	N	N	N
JEAN LYKES	43	100.0	N	N	N
JEB STUART	2	100.0	N	N	N
JEBEL ALI	63	74.6	Y	Y	N
JENS KOFOED	13	100.0	N	N	N
JO ELM	31	100.0	N	N	N
JOHN G. MUNSON	227	94.7	Y	Y	Y
JOHN J. BOLAND	77	63.6	N	N	L
JOHN YOUNG	29	0.0	Y	Y	Y
JOSEPH H. FRANTZ	90	86.6	Y	Y	Y
JOSEPH L. BLOCK	67	74.6	N	N	L
JOSEPH LYKES	65	100.0	N	N	N
JUBILANT	17	100.0	N	N	N
JULIUS HAMMER	27	100.0	N	N	N
JUPITER DIAMOND	53	100.0	N	N	N
KAIJIN	115	94.7	Y	Y	N
KAKUSHIMA	34	100.0	N	N	N
KANSAS TRADER	60	65.0	Y	Y	N
KAPITAN BOCHEK	6	100.0	N	N	N
KAPITAN BYANKIN	178	92.1	Y	Y	Y
KAPITAN GNEZPILOV	82	100.0	N	N	N
KAPITAN KONEV	186	93.0	Y	Y	Y
KAPITAN MAN	97	100.0	N	N	N
KAPITAN SERYKH	122	77.0	Y	Y	N
KAUAI	190	75.2	Y	Y	Y
KAYE E. BARKER	250	79.2	Y	Y	Y
KAZIMAH	153	100.0	N	N	N
KEE LUNG	17	100.0	N	N	N
KEMEROVO	15	100.0	N	N	N
KENAI	49	100.0	N	N	N
KENNETH E. HILL	105	67.6	Y	Y	Y
KENNETH T. DERR	2	100.0	N	N	N
KENTUCKY HIGHWAY	47	100.0	N	N	N
KINSMAN INDEPENDENT	153	71.2	N	N	L
KISHORE	3	100.0	N	N	N
KISTA ARCTICA	296	100.0	N	N	N
KITTANING	159	28.3	Y	N	N
KNOCK ALLAN	45	100.0	N	N	N
KNORR	66	100.0	N	N	N
KOELN EXPRESS	291	100.0	N	N	N
KOMSOMOLETS PRIMORYA	12	100.0	N	N	N
KONSTANTINOS A	8	100.0	N	N	N
KURE	69	98.5	Y	Y	Y
LA TRINITY	78	92.3	Y	Y	Y
LAKE GUARDIAN	32	59.3	Y	Y	Y
LAWRENCE H. GIANELLA	46	78.2	Y	Y	Y
LEE A. TREGURTHA	65	64.6	Y	Y	Y
LEGEND OF THE SEAS	189	90.4	Y	Y	Y
LEON	43	100.0	N	N	N
LEONARD J. COWLEY	36	100.0	N	N	N
LEONIA	155	100.0	N	N	N
LERMA	10	100.0	N	N	N
LIBERTY SPIRIT	10	100.0	N	N	N
LIBERTY STAR	127	44.0	Y	Y	Y
LIBERTY SUN	134	45.5	Y	Y	Y
LIBERTY VICTORY	125	32.8	Y	Y	Y
LIBERTY WAVE	20	100.0	Y	Y	N
LIHUE	74	28.3	Y	Y	N
LINDA OLDENDORF	129	91.4	Y	Y	N
LIRCAY	20	100.0	N	N	N
LNG AQUARIUS	239	23.0	Y	Y	Y
LNG CAPRICORN	20	100.0	N	N	N
LNG LEO	85	58.8	Y	Y	Y
LNG LIBRA	6	100.0	N	N	N
LNG TAURUS	37	37.8	Y	N	N
LNG VIRGO	77	74.0	Y	Y	Y
LONDON ENTERPRISE	37	100.0	N	N	N
LONDON SPIRIT	122	100.0	N	N	N
LONG BEACH	142	80.2	Y	Y	N
LONG LINES	143	0.0	N	N	L
LOOTSGRACHT	73	100.0	N	N	N
LOS ANGELES	42	100.0	N	N	N
LOUISIANA	17	100.0	N	N	N
LT ARGOSY	54	42.5	N	N	L
LT PRAGATI	10	100.0	N	N	N
LT. ODYSSEY	2	100.0	N	N	N
LTC CALVIN P. TITUS	3	100.0	N	N	N
LUCKY	23	100.0	N	N	N
LUCKY BULKER	150	100.0	N	N	N
LUCKY GRACE	193	0.0	Y	Y	Y
LUNA MAERSK	172	51.7	Y	Y	Y
LURLINE	177	44.6	Y	Y	Y
M. P. GRACE	16	100.0	N	N	N
MAASDAM	50	100.0	N	N	N
MACKINAC BRIDGE	217	94.0	Y	Y	Y
MADISON MAERSK	62	0.0	Y	Y	Y
MAERSK CHARLESTON	19	100.0	N	N	N
MAERSK CONSTELLATION	96	73.9	N	N	L
MAERSK ENDEAVOUR	499	100.0	N	N	N
MAERSK EXPLORER	510	100.0	N	N	N
MAERSK GANNET	148	100.0	N	N	N
MAERSK GIANT	120	100.0	N	N	N
MAERSK LA PAZ	41	26.8	N	N	L
MAERSK LIMA	21	66.6	Y	N	N
MAERSK SHETLAND	52	100.0	N	N	N
MAERSK SOMERSET	124	88.7	N	N	L
MAERSK STAFFORD	67	100.0	N	N	N
MAERSK SUN	77	100.0	N	N	N
MAERSK TANJONG	94	80.8	Y	Y	N
MAERSK VANCOUVER	17	0.0	N	N	L
MAERSK YOKOHAMA	36	100.0	N	N	N
MAGLEBY MAERSK	102	46.0	Y	Y	Y
MAHARASHTRA	94	80.8	Y	Y	Y
MAHIMAHI	161	75.1	Y	Y	Y
MAIRANGI BAY	131	100.0	N	N	N
MAJ STEPHEN W PLESS MP	77	70.1	Y	Y	N
MAJESTIC MAERSK	79	24.0	Y	Y	Y
MALCOLM BALDRIGE	594	71.0	Y	Y	Y
MALMNES	24	0.0	Y	N	N
MANGAL DESAI	266	25.1	Y	Y	Y
MANHATTAN BRIDGE	165	67.2	Y	Y	Y
MANOA	198	62.1	Y	Y	Y
MANUKAI	174	45.4	Y	Y	Y
MANULANI	159	37.1	Y	Y	Y
MARCARRIER	109	100.0	N	N	N
MARCHEN MAERSK	99	66.6	Y	Y	N
MAREN MAERSK	73	1.3	Y	Y	Y
MARGARET LYKES	119	38.6	Y	Y	Y
MARGRETHE MAERSK	28	10.7	Y	N	N
MARIA LAURA	110	97.2	Y	N	N
MARIA TOPIC	42	100.0	N	N	N
MARIE MAERSK	77	79.2	Y	Y	Y
MARINE EXPRESS	3	100.0	N	N	N
MARINE RELIANCE	2	100.0	N	N	N
MARIT MAERSK	108	80.5	Y	Y	Y
MARK HANNAH	150	64.0	N	N	L
MARLIN	160	3.1	Y	Y	Y
MARY PAGE HANNAH	13	38.4	Y	Y	N
MATHILDE MAERSK	103	68.9	Y	Y	Y
MATSONIA	180	35.0	Y	Y	Y
MAUI	164	84.7	Y	Y	Y
MAURICE EWING	289	34.2	Y	Y	Y

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NAME	TOTAL OBS	PERCENT VIA RADIO	MANUSCRIPT RECEIVED APR	MAY	JUN
MAYAGUEZ	251	64.1	Y	Y	Y
MAYVIEW MAERSK	77	44.1	Y	Y	Y
MC-KINNEY MAERSK	108	75.9	Y	Y	Y
MEARSK NEWARK	30	56.6	N	N	L
MEDALLION	26	100.0	N	N	N
MEDUSA CHALLENGER	247	76.5	Y	Y	Y
MELBOURNE STAR	67	100.0	N	N	N
MELVILLE	172	96.5	N	N	L
MERCHANT PARAMOUNT	62	100.0	N	N	N
MERCHANT PREMIER	124	100.0	N	N	N
MERCHANT PRESTIGE	18	100.0	N	N	N
MERCHANT PRINCE	39	100.0	N	N	N
MERCHANT PRINCIPAL	161	100.0	N	N	N
MERCURY DIAMOND	45	100.0	N	N	N
MERIDA	176	80.6	Y	Y	Y
MERIDIAN	85	0.0	Y	Y	Y
MERLION ACE	211	18.0	Y	Y	Y
MESABI MINER	147	88.4	Y	Y	Y
METEOR	595	100.0	N	N	N
METTE MAERSK	135	57.7	Y	Y	Y
MICHIGAN	225	58.2	Y	Y	Y
MIDDLETOWN	76	78.9	N	N	L
MILDBURG	186	100.0	N	N	N
MINERAL OSPREY	28	100.0	N	N	N
MING ASIA	11	100.0	N	N	N
MING PEACE	78	100.0	N	N	N
MING PLEASURE	135	100.0	N	N	N
MING PROPITIOUS	31	100.0	N	N	N
MITLA	205	74.6	N	N	N
MOANA PACIFIC	104	100.0	N	N	N
MOANA WAVE	594	0.0	N	N	N
MOEN	115	100.0	N	N	N
MOKIHANA	171	77.7	Y	Y	Y
MOKU PAHU	57	66.6	Y	N	N
MONTERREY	234	95.2	Y	Y	Y
MORELOS	176	64.2	N	N	L
MORMACSKY	41	70.7	N	N	L
MORMACSTAR	92	32.6	N	N	L
MORMACSUN	42	71.4	Y	N	N
MOSEL ORE	232	90.5	Y	Y	N
MYRON C. TAYLOR	193	77.7	N	N	L
NAJA ARCTICA	206	100.0	N	N	N
NARA	6	100.0	N	N	N
NATIONAL DIGNITY	40	77.5	Y	Y	Y
NATIONAL HONOR	50	82.0	Y	Y	Y
NATIONAL PRIDE	85	15.2	Y	Y	N
NAUTICAS MEXICO	123	57.7	N	N	L
NEDLLOYD DELFT	183	100.0	N	N	N
NEDLLOYD HOLLAND	171	61.4	Y	Y	Y
NEDLLOYD RALEIGH BAY	140	100.0	N	N	N
NEDLLOYD ROTTERDAM	58	100.0	N	N	N
NEDLLOYD VAN CLOON	91	100.0	N	N	N
NEDLLOYD VAN DAJIMA	34	100.0	N	N	N
NEDLLOYD VAN DIEMEN	96	100.0	N	N	N
NEGO LOMBOK	69	92.7	Y	Y	N
NELVANA	145	55.1	Y	Y	Y
NEPTUNE ACE	102	100.0	N	N	N
NEPTUNE AKABAR	30	0.0	Y	N	N
NEPTUNE ALDEBARAN	31	100.0	N	N	N
NEPTUNE ALTAIR	2	100.0	N	N	N
NEPTUNE CORAL	6	100.0	N	N	N
NEPTUNE CRYSTAL	4	100.0	N	N	N
NEPTUNE GARNET	233	12.4	N	N	L
NEPTUNE JADE	27	100.0	N	N	N
NEPTUNE PEARL	23	100.0	N	N	N
NEW CARISSA	222	47.2	Y	Y	Y
NEW HORIZON	59	81.3	N	N	L
NEW NIKKI	177	94.9	Y	Y	Y
NEW YORK SENATOR	112	100.0	N	N	N
NEW YORK SUN	89	86.5	Y	Y	Y
NEWARK BAY	164	90.8	Y	Y	N
NEWPORT BRIDGE	64	100.0	N	N	N
NIEUW AMSTERDAM	25	100.0	N	N	N
NOAA DAVID STARR JORDA	115	41.7	Y	Y	Y
NOAA SHIP ALBATROSS IV	367	0.8	Y	Y	Y
NOAA SHIP CHAPMAN	313	42.4	Y	Y	N
NOAA SHIP DISCOVERER O	322	89.4	Y	Y	Y
NOAA SHIP FERREL	285	92.2	Y	Y	Y
NOAA SHIP KA'IMIMOANA	169	84.0	N	N	L
NOAA SHIP MCARTHUR	365	86.3	Y	Y	Y
NOAA SHIP MILLER FREEM	467	89.9	Y	Y	Y
NOAA SHIP OREGON II	444	73.1	Y	Y	Y
NOAA SHIP RAINIER	293	84.9	N	N	L
NOAA SHIP T. CROMWELL	617	40.1	N	N	L
NOAA SHIP WHITING	446	88.3	Y	Y	Y
NOBEL STAR	92	60.8	Y	Y	N
NOL AMBER	37	45.9	N	N	L
NOL DELPHI	91	100.0	N	N	N
NOL DIAMOND	13	100.0	N	N	N
NOL RUBY	77	100.0	N	N	N
NOL TOPAZ	22	100.0	N	N	N
NOL ZIRCON	3	100.0	N	N	N
NOMZI	282	94.3	Y	N	N
NORASIA SHANGHAI	15	100.0	N	N	N
NORD JAHRE TRANSPORTER	16	100.0	N	N	N
NORDIC EMPRESS	57	64.9	Y	Y	Y
NORTHERN LIGHTS	178	94.9	N	N	L
NORTHERN LION	576	47.0	Y	Y	N
NORWAY	43	74.4	Y	Y	N
NOSAC GALAXY	9	100.0	N	N	N
NOSAC STAR	73	43.8	Y	Y	N
NOSAC TAKARA	65	56.9	Y	Y	Y
NOSAC TAKAYAMA	120	71.6	Y	Y	Y
NOSAC TANABATA	2	100.0	N	N	N
NTABENI	162	100.0	N	N	N
NUERNBERG EXPRESS	101	100.0	N	N	N
NUEVO LEON	120	100.0	N	N	N
NUEVO SAN JUAN	209	46.8	Y	Y	Y
NUKA ARCTICA	290	100.0	N	N	N
NYK SEABREEZE	79	100.0	N	N	N
NYK SPRINGTIDE	79	100.0	N	N	N
NYK STARLIGHT	50	100.0	N	N	N
NYK SUNRISE	94	100.0	N	N	N
NYK SURFWIND	47	100.0	N	N	N
OBO ELIF	13	100.0	N	N	N
OCEAN GREAT	83	49.3	N	N	L
OCEAN JADE	327	18.6	Y	Y	Y
OCEAN LAUREL	76	51.3	Y	Y	Y
OCEAN ORCHID	42	100.0	Y	Y	N
OCEAN SERENE	49	85.7	Y	Y	Y
OCEAN SPIRIT	56	100.0	N	N	N
OCEANBREEZE	103	95.1	Y	Y	Y
OJI PIONEER	143	51.0	Y	Y	Y
OLAVUR HALGI	260	100.0	N	N	N
OLEANDER	150	97.3	Y	Y	Y
OLIVEBANK	48	100.0	N	N	N
OLYMPIAN HIGHWAY	42	61.9	Y	Y	Y
OMI COLUMBIA	43	76.7	N	N	L
OOCL AMERICA	72	93.0	Y	Y	N
OOCL BRAVERY	105	100.0	N	N	N
OOCL CALIFORNIA	59	100.0	N	N	N
OOCL CHINA	112	96.4	Y	Y	Y

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NAME	TOTAL OBS	PERCENT VIA RADIO	MANUSCRIPT RECEIVED APR	MAY	JUN
OOCL ENVOY	46	97.8	N	N	L
OOCL FAIR	44	100.0	N	N	N
OOCL FAITH	67	100.0	N	N	N
OOCL FAME	89	100.0	N	N	N
OOCL FIDELITY	92	81.5	Y	Y	Y
OOCL FORTUNE	87	96.5	Y	Y	Y
OOCL FREEDOM	147	100.0	N	N	N
OOCL FRIENDSHIP	44	100.0	N	N	N
OOCL FRONTIER	64	85.9	Y	Y	Y
OOCL HONG KONG	155	98.7	Y	Y	N
OOCL INNOVATION	151	59.6	Y	Y	N
OOCL INSPIRATION	171	66.6	Y	Y	Y
OOCL JAPAN	94	100.0	N	N	N
ORANGE BLOSSOM	79	26.5	Y	Y	Y
ORCHIS ISLAND	36	38.8	Y	N	N
OREGON RAINBOW III	57	100.0	N	N	N
ORIENTE GRACE	96	84.3	Y	Y	N
ORIENTE NOBLE	145	20.0	Y	Y	Y
ORIENTE PRIME	41	87.8	Y	Y	Y
ORION HIGHWAY	142	100.0	N	N	N
OSAKA BAY	2	100.0	N	N	N
OURO DO BRASIL	55	100.0	N	N	N
OVERSEAS ALASKA	23	100.0	N	N	N
OVERSEAS ARCTIC	31	77.4	Y	N	N
OVERSEAS CHICAGO	25	28.0	Y	N	N
OVERSEAS HARRIET	45	13.3	N	N	L
OVERSEAS JOYCE	105	100.0	N	N	N
OVERSEAS JUNEAU	164	0.0	Y	Y	Y
OVERSEAS MARILYN	72	54.1	Y	N	N
OVERSEAS NEW ORLEANS	61	73.7	Y	Y	Y
OVERSEAS NEW YORK	26	53.8	N	N	L
OVERSEAS OHIO	43	79.0	Y	Y	N
OVERSEAS WASHINGTON	89	24.7	N	N	L
PACASIA	167	49.1	Y	Y	Y
PACDUKE	45	100.0	N	N	N
PACIFIC GUARDIAN	19	100.0	N	N	N
PACIFIC HIRO	95	93.6	Y	Y	N
PACIFIC HOPE	73	90.4	N	N	L
PACIFIC PINTAIL	159	100.0	N	N	N
PACIFIC PRINCESS	65	100.0	N	N	N
PACIFIC SANDPIPER	243	100.0	N	N	N
PACIFIC TEAL	155	100.0	N	N	N
PACIFIC UNIVERSAL	213	100.0	N	N	N
PACIFIC VENTURE	125	100.0	N	N	N
PACIFIC WAVE	50	100.0	N	N	N
PACMERCHANT	26	100.0	N	N	N
PACPRINCE	13	100.0	N	N	N
PACPRINCESS	13	100.0	N	N	N
PACQUEEN	73	67.1	Y	Y	Y
PACSEA	27	100.0	N	N	N
PAJUTTAAT	2	100.0	N	N	N
PAMIUT	8	100.0	N	N	N
PAN DYNAMIC	26	100.0	N	N	N
PATRIOT	118	78.8	N	N	L
PATRIOT STATE	36	100.0	N	N	N
PAUL BUCK	111	45.9	N	N	L
PAUL H. TOWNSEND	56	71.4	Y	Y	N
PAUL R. TREGURTHA	261	94.6	Y	Y	Y
PEGGY DOW	47	100.0	N	N	N
PFC DEWAYNE T. WILLIAM	104	29.8	Y	Y	N
PFC EUGENE A. OBREGON	24	4.1	N	N	L
PHAROS	34	100.0	N	N	N
PHILADELPHIA	98	0.0	N	N	L
PHILIP R. CLARKE	295	82.7	Y	Y	Y
PHOENIX DIAMOND	27	100.0	N	N	N
PISCES EXPLORER	24	100.0	N	N	N
PISCES PIONEER	184	100.0	N	N	N
PISCES PLANTER	102	100.0	N	N	N
PLATTE	107	23.3	Y	Y	N
POLAR EAGLE	151	22.5	Y	Y	Y
POLYNESIA	3	100.0	N	N	N
POROS	51	94.1	N	N	L
PORT STAR	6	100.0	N	N	N
POTOMAC TRADER	31	80.6	N	N	L
POVL ANKER	9	100.0	N	N	N
POYANG	102	100.0	N	N	N
POYARKOVO	3	100.0	N	N	N
PRESIDENT ADAMS	162	79.0	Y	Y	Y
PRESIDENT EISENHOWER	108	95.3	Y	N	N
PRESIDENT F. ROOSEVELT	100	90.0	Y	N	N
PRESIDENT JACKSON	107	0.0	Y	Y	Y
PRESIDENT KENNEDY	128	82.0	Y	Y	N
PRESIDENT POLK	170	74.7	Y	Y	Y
PRESIDENT TRUMAN	77	61.0	Y	Y	N
PRESQUE ISLE	94	71.2	N	N	L
PRIDE OF BALTIMORE II	78	79.4	Y	Y	N
PRINCE OF OCEAN	159	52.2	Y	Y	N
PRINCE OF SCANDINAVIA	19	100.0	N	N	N
PRINCE OF TOKYO 2	268	45.1	Y	Y	Y
PRINCE WILLIAM SOUND	5	100.0	N	N	N
PRINCESS OF SCANDINAVI	201	100.0	N	N	N
PROJECT ORIENT	74	100.0	N	N	N
PUERTO CORTES	64	100.0	N	N	N
PYTCHLEY	141	100.0	N	N	N
QUEEN ELIZABETH 2	166	100.0	N	N	N
QUEEN OF SCANDINAVIA	305	100.0	N	N	N
QUEENSLAND STAR	191	100.0	N	N	N
R. HAL DEAN	3	100.0	N	N	N
R.J. PFEIFFER	84	76.1	Y	Y	Y
RANGER	130	50.7	Y	Y	Y
RANI PADMINI	5	100.0	N	N	N
REGAL EMPRESS	18	100.0	N	N	N
REGAL PRINCESS	57	100.0	N	N	N
REGINA J	20	30.0	Y	Y	N
REPULSE BAY	112	100.0	N	N	N
RESERVE	66	92.4	Y	Y	Y
RESOLUTE	55	100.0	Y	N	N
RHINE FOREST	181	51.3	Y	Y	Y
RICHARD G MATTIESEN	76	100.0	N	N	N
RICHARD REISS	56	91.0	Y	Y	Y
RICHMOND BAY	39	100.0	N	N	N
ROBERT E. LEE	47	27.6	Y	N	N
ROGER BLOUGH	304	90.7	Y	Y	Y
ROSINA TOPIC	50	84.0	Y	Y	Y
ROSITA	208	82.6	Y	Y	Y
ROTTERDAM	10	100.0	N	N	N
ROVER	16	100.0	N	N	N
ROYAL MAJESTY	83	1.2	Y	Y	Y
ROYAL PRINCESS	68	100.0	N	N	N
RUBIN BONANZA	116	93.9	Y	Y	Y
RUBIN KOBE	179	95.5	Y	N	N
RUBIN PEARL	10	100.0	N	N	N
RUBIN STAR	21	57.1	N	N	L
RUBIN STELLA	133	37.5	Y	Y	Y
RYNDAM	20	100.0	N	N	N
S.T. CRAPO	202	87.6	Y	Y	Y
S/S WILSON	25	64.0	N	N	L
SAGA CREST	23	100.0	N	N	N
SALINAS	27	100.0	N	N	N
SALLEQ	48	100.0	N	N	N
SALOME	192	60.9	Y	Y	Y
SAM HOUSTON	55	49.0	Y	N	N

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NAME	TOTAL OBS	PERCENT VIA RADIO	MANUSCRIPT RECEIVED APR	MAY	JUN
SAMSON	99	100.0	N	N	N
SAMUEL GINN	108	42.5	Y	Y	Y
SAMUEL H. ARMACOST	138	31.1	Y	N	N
SAMUEL L. COBB	38	18.4	N	N	L
SAMUEL RISLEY	517	100.0	N	N	N
SAN ISIDRO	52	100.0	N	N	N
SAN MARCOS	20	100.0	N	N	N
SAN VINCENTE	96	100.0	N	N	N
SANKO POPPY	100	52.0	Y	Y	N
SANTORIN 2	467	23.3	Y	Y	Y
SAQQITITTUK	119	100.0	N	N	N
SARAMATI	136	66.9	N	N	L
SARFAQITTUK	110	100.0	N	N	N
SAUDI DIRIYAH	11	100.0	N	N	N
SCHACKENBORG	6	100.0	N	N	N
SEA COMMERCE	149	62.4	Y	Y	Y
SEA FLORIDA	130	76.9	Y	Y	Y
SEA FOX	120	93.3	N	N	L
SEA HARMONY	55	100.0	N	N	N
SEA INITIATIVE	160	100.0	N	N	N
SEA ISLE CITY	141	24.8	Y	Y	N
SEA JUSTICE	196	93.8	Y	Y	Y
SEA LION	95	71.5	Y	Y	Y
SEA MARINER	138	76.8	Y	Y	Y
SEA MERCHANT	461	93.2	Y	Y	Y
SEA NOVIA	72	56.9	Y	Y	N
SEA PRINCESS	35	100.0	N	N	N
SEA SPRAY	9	100.0	N	N	N
SEA TRADE	138	100.0	N	N	N
SEA VISTA	58	100.0	N	N	N
SEA WOLF	243	93.8	Y	Y	N
SEA-LAND COLOMBIA	87	0.0	N	N	L
SEABOARD OCEAN	112	8.0	Y	Y	Y
SEABOARD SUN	54	0.0	Y	Y	Y
SEABOARD UNIVERSE	105	85.7	Y	Y	Y
SEABREEZE I	34	91.1	Y	Y	Y
SEACHAMPION	89	91.0	N	N	L
SEALAND ANCHORAGE	132	50.7	Y	Y	N
SEALAND ATLANTIC	161	93.1	Y	Y	Y
SEALAND CHALLENGER	74	56.7	Y	Y	Y
SEALAND CHAMPION	163	87.7	Y	Y	Y
SEALAND COMET	188	92.5	Y	Y	Y
SEALAND CONSUMER	82	87.8	N	N	L
SEALAND COSTA RICA	14	100.0	Y	Y	N
SEALAND CRUSADER	153	88.2	Y	Y	Y
SEALAND DEFENDER	146	71.9	Y	Y	Y
SEALAND DEVELOPER	110	38.1	Y	Y	Y
SEALAND DISCOVERY	130	53.8	Y	Y	Y
SEALAND ENDURANCE	126	34.1	Y	Y	Y
SEALAND ENTERPRISE	263	60.8	Y	Y	Y
SEALAND EXPEDITION	47	89.3	Y	Y	N
SEALAND EXPLORER	197	88.8	Y	Y	Y
SEALAND EXPRESS	131	82.4	Y	Y	Y
SEALAND HAWAII	142	95.0	Y	Y	N
SEALAND INDEPENDENCE	99	37.3	N	N	L
SEALAND INNOVATOR	163	89.5	Y	Y	Y
SEALAND INTEGRITY	318	66.6	Y	Y	Y
SEALAND KODIAK	67	2.9	Y	N	N
SEALAND LIBERATOR	35	100.0	N	N	N
SEALAND MERCURY	142	100.0	N	N	N
SEALAND METEOR	148	94.5	N	N	L
SEALAND NAVIGATOR	208	92.3	Y	Y	Y
SEALAND PACIFIC	211	91.4	Y	Y	Y
SEALAND PATRIOT	101	82.1	Y	Y	N
SEALAND PERFORMANCE	151	88.7	Y	Y	Y
SEALAND PRODUCER	145	81.3	Y	Y	N
SEALAND QUALITY	58	36.2	Y	Y	N
SEALAND RACER	44	100.0	N	N	N
SEALAND RELIANCE	159	83.6	Y	N	N
SEALAND SPIRIT	139	34.5	Y	Y	Y
SEALAND TACOMA	103	41.7	Y	Y	Y
SEALAND TRADER	214	92.5	Y	Y	Y
SEALAND VOYAGER	177	83.0	Y	Y	Y
SEARIVER BATON ROUGE	12	83.3	N	N	L
SEARIVER BENICIA	53	71.6	Y	Y	N
SEARIVER CHARLESTOWN	10	90.0	Y	N	N
SEARIVER LONG BEACH	7	100.0	N	N	N
SEARIVER SAN FRANCISCO	13	69.2	Y	Y	N
SEDCO/BP 471	281	69.7	Y	Y	Y
SENATOR	95	100.0	N	N	N
SENORITA	137	37.9	Y	Y	Y
SENSATION	79	87.3	Y	Y	Y
SERENITY	176	30.1	Y	Y	Y
SETO BRIDGE	133	100.0	N	N	N
SEVEN OCEAN	37	97.2	Y	Y	Y
SEWARD JOHNSON	98	100.0	N	N	N
SGT WILLIAM A BUTTON	128	35.9	Y	N	N
SGT. METEJ KOCAK	53	77.3	Y	Y	Y
SHELDON LYKES	17	17.6	N	N	L
SHELLY BAY	33	87.8	Y	Y	Y
SHIN OJI	64	100.0	N	N	N
SHIRAOI MARU	224	86.1	Y	Y	Y
SIBOHELLE	83	43.3	Y	Y	Y
SIDNEY STAR	163	100.0	N	N	N
SIERRA MADRE	29	72.4	N	N	L
SIGAL	2	100.0	N	N	N
SINCERE GEMINI	27	100.0	N	N	N
SINGAPORE EXPRESS	138	7.9	Y	Y	N
SISIMIUT	335	100.0	N	N	N
SKAUBRYN	109	100.0	N	N	N
SKAUGRAN	60	100.0	N	N	N
SKOGAFOSS	141	100.0	N	N	N
SKY PRINCESS	17	100.0	N	N	N
SOKOLICA	134	97.0	Y	Y	Y
SOL DO BRASIL	77	100.0	N	N	N
SOLAR WING	66	100.0	N	N	N
SONG OF AMERICA	2	100.0	N	N	N
SONORA	186	77.4	Y	Y	N
SOREN TOUBRO	39	100.0	N	N	N
SOUTHERN LION	99	100.0	N	N	N
SOUTHERN PRINCESS	224	0.0	N	N	L
SOVEREIGN OF THE SEAS	106	90.5	Y	Y	N
SP5. ERIC G. GIBSON	88	57.9	N	N	L
SPRING BEAR	209	100.0	N	N	N
SPRING GANNET	217	42.3	Y	Y	Y
STAR ALABAMA	13	100.0	N	N	N
STAR AMERICA	90	74.4	N	N	L
STAR DAVANGER	23	100.0	N	N	N
STAR EAGLE	35	100.0	N	N	N
STAR EVVIVA	152	52.6	Y	Y	Y
STAR FLORIDA	133	3.7	Y	Y	N
STAR FRASER	138	84.7	N	N	L
STAR FUJI	85	100.0	N	N	N
STAR GRAN	43	100.0	N	N	N
STAR HANSA	48	100.0	N	N	N
STAR HERDLA	183	84.6	Y	Y	Y
STAR SKARVEN	138	37.6	Y	Y	Y
STAR STRONEN	120	19.1	N	N	L
STATE OF GUIARAT	1	100.0	N	N	N
STELLA	6	100.0	N	N	N
STELLA LYKES	61	49.1	N	N	L
STEPAN KRASHENINNIKOV	18	100.0	N	N	N

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NAME	TOTAL OBS	PERCENT VIA RADIO	MANUSCRIPT RECEIVED APR	MAY	JUN
STEPHAN J	289	86.8	Y	Y	Y
STEWART J. CORT	211	87.2	Y	Y	Y
STOLT CONDOR	23	100.0	N	N	N
STOLT EAGLE	3	100.0	N	N	N
STOLT JADE	61	100.0	N	N	N
STOLT RESOLUTE	53	100.0	N	N	N
STOLT VINLAND	20	100.0	N	N	N
STONEWALL JACKSON	22	100.0	N	N	N
STRONG CAJUN	112	86.6	Y	Y	Y
STRONG ICELANDER	143	93.7	N	N	L
STRONG VIRGINIAN	173	22.5	Y	Y	Y
SUN PRINCESS	6	100.0	N	N	N
SUNBELT DIXIE	46	100.0	N	N	N
SUNDA	90	100.0	N	N	N
SUPER RUBIN	166	92.7	Y	Y	Y
SVEN OLTMANN	79	100.0	N	N	N
SWAN ARROW	18	100.0	N	N	N
TAI HE	167	100.0	N	N	N
TAI SHING	102	33.3	N	N	L
TALLAHASSEE BAY	42	100.0	N	N	N
TAMPA BAY	90	15.5	N	N	L
TARAGO	123	100.0	N	N	N
TELLUS	156	58.3	Y	Y	N
TEPOZTECO II	104	100.0	N	N	N
TEQUI	179	69.2	Y	Y	Y
TEXAS CLIPPER	32	100.0	N	N	N
THETIS	113	100.0	N	N	N
THOMAS G. THOMPSON	28	100.0	N	N	N
THOMPSON LYKES	76	46.0	Y	Y	Y
THORKIL MAERSK	25	100.0	N	N	N
TILLIE LYKES	147	42.8	Y	Y	Y
TIMIARMIUT	75	100.0	N	N	N
TJALDRID	119	100.0	N	N	N
TMM MEXICO	67	94.0	N	N	L
TOKIO EXPRESS	23	100.0	N	N	N
TOLUCA	210	8.0	Y	N	N
TONSINA	113	61.9	Y	N	N
TOR CALEDONIA	49	100.0	N	N	N
TOR DANIA	357	100.0	N	N	N
TORBEN	324	27.1	Y	Y	Y
TORM FREYA	51	76.4	Y	N	N
TOWER BRIDGE	34	100.0	N	N	N
TOYOSHIMA MARU	51	92.1	N	N	L
TRANSWORLD BRIDGE	115	92.1	Y	Y	Y
TRIGGER	20	100.0	N	N	N
TRITON	357	92.9	N	N	L
TROPIC DAY	25	76.0	Y	Y	Y
TROPIC FLYER	24	25.0	Y	Y	N
TROPIC ISLE	126	0.0	Y	Y	Y
TROPIC JADE	107	17.7	Y	Y	Y
TROPIC KEY	33	6.0	Y	Y	Y
TROPIC LURE	99	1.0	Y	Y	Y
TROPIC MIST	37	0.0	Y	Y	Y
TROPIC OPAL	63	0.0	Y	Y	Y
TROPIC SUN	151	82.7	Y	Y	Y
TROPIC TIDE	86	83.7	Y	Y	Y
TRSL ARCTURUS	108	81.4	Y	Y	Y
TRUST 38	63	100.0	N	N	N
TULSIDAS	21	100.0	N	N	N
TULUGAQ	61	100.0	N	N	N
TURMOIL	122	99.1	N	N	L
TYSON LYKES	93	30.1	Y	Y	Y
ULLSWATER	164	100.0	N	N	N
USCGC ACACIA (WLB406)	15	100.0	N	N	N
USCGC ACUSHNET WMEC 16	67	100.0	N	N	N
USCGC ALERT (WMEC 630)	202	74.7	Y	Y	N
USCGC BASSWOOD (WLB 38	44	100.0	N	N	N
USCGC BEAR (WEMC 901)	19	94.7	Y	N	N
USCGC BOUTWELL WHEC 71	19	100.0	N	N	N
USCGC BRAMBLE (WLB 392	1	0.0	N	N	L
USCGC CAMPBELL	26	69.2	Y	N	N
USCGC CHASE (WHEC 718)	48	100.0	N	N	N
USCGC CONFIDENCE WMEC6	48	100.0	N	N	N
USCGC COURAGEOUS	28	57.1	N	N	L
USCGC DAUNTLESS WMEC 6	175	39.4	Y	Y	Y
USCGC DECISIVE WMEC 62	12	100.0	N	N	N
USCGC DILIGENCE WMEC 6	34	100.0	N	N	N
USCGC DURABLE (WMEC 62	51	100.0	N	N	N
USCGC EAGLE (WIX 327)	21	100.0	N	N	N
USCGC FIREBUSH WLB 393	36	100.0	N	N	N
USCGC FORWARD	35	100.0	N	N	N
USCGC GALLATIN	22	100.0	N	N	N
USCGC HAMILTON WHEC 71	2	100.0	N	N	N
USCGC HARRIET LANE	30	100.0	N	N	N
USCGC JARVIS (WHEC 725	728	18.4	N	N	L
USCGC LEGARE	98	79.5	Y	Y	Y
USCGC MACKINAW	1	100.0	N	N	N
USCGC MALLOW (WLB 396)	11	100.0	N	N	N
USCGC MELLON (WHEC 717	99	100.0	N	N	N
USCGC MIDGETT (WHEC 72	53	88.6	Y	N	N
USCGC MOHAWK WMEC 913	14	100.0	N	N	N
USCGC MORGENTHAU	1	100.0	N	N	N
USCGC MUNRO	94	89.3	Y	Y	Y
USCGC NORTHLAND WMEC 9	56	100.0	N	N	N
USCGC POLAR SEA__(WAGB	230	100.0	N	N	N
USCGC POLAR STAR (WAGB	16	100.0	N	N	N
USCGC RELIANCE WMEC 61	9	100.0	N	N	N
USCGC RUSH	69	100.0	N	N	N
USCGC SASSAFRAS	16	68.7	N	N	L
USCGC SEDGE (WLB 402)	34	100.0	N	N	N
USCGC SENECA	123	100.0	N	N	N
USCGC SHERMAN	71	100.0	N	N	N
USCGC SPENCER	11	100.0	N	N	N
USCGC STEADFAST (WMEC	63	100.0	N	N	N
USCGC STORIS (WMEC 38)	81	92.5	Y	N	N
USCGC SUNDEW (WLB 404)	60	80.0	Y	N	N
USCGC SWEETBRIER WLB 4	49	100.0	N	N	N
USCGC TAHOMA	71	80.2	N	N	L
USCGC THETIS	24	4.1	Y	N	N
USCGC VENTUROUS WMEC 6	3	100.0	N	N	N
USCGC VIGOROUS WMEC 62	60	63.3	N	N	L
USCGC WOODRUSH (WLB 40	1	100.0	N	N	N
USCGC YOCONA (WMEC 168	51	100.0	N	N	N
USNS ALGOL	26	100.0	N	N	N
USNS APACHE (T-ATF 172	20	100.0	N	N	N
USNS BIGHORN	210	0.0	Y	Y	Y
USNS GUADALUPE	4	100.0	N	N	N
USNS GUS W. DARNELL	94	62.7	Y	Y	Y
USNS HENRY J. KAISER	17	70.5	N	N	L
USNS JOHN MCDONNELL (T	48	87.5	Y	N	N
USNS KANE TAGS 27	86	33.7	N	N	L
USNS LARAMIE T-AO 203	5	100.0	N	N	N
USNS MOHAWK (T-ATF 170	37	100.0	N	N	N
USNS NARRAGANSETT	62	100.0	N	N	N
USNS NAVAJO_(TATF-169)	169	52.6	Y	Y	Y
USNS PATHFINDER T-AGS	71	49.2	Y	Y	Y
USNS PATUXENT	35	100.0	N	N	N
USNS PECOS	54	100.0	N	N	N
USNS POLLUX	94	21.2	N	N	L
USNS POWHATAN TATF 166	115	89.5	Y	Y	Y
USNS RAPPAHANNOCK TAO-	1	100.0	N	N	N
USNS SAN DIEGO	63	100.0	N	N	N

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NAME	TOTAL OBS	PERCENT VIA RADIO	MANUSCRIPT RECEIVED APR	MAY	JUN
USNS SILAS BENT T-AGS	73	100.0	Y	N	N
USNS SPICA (T-AFS 9)	5	100.0	N	N	N
USNS TIPPECANOE (TAO-1	64	76.5	N	N	L
USNS VANGUARD TAG 194	89	100.0	N	N	N
USNS WYMAN (T-AGS 34)	179	100.0	N	N	N
USNS YUKON (T-AO 202)	41	85.3	N	N	L
USS RUSSELL DDG-59	92	100.0	N	N	N
VAEDDEREN	361	100.0	N	N	N
VAN TRADER	29	100.0	N	N	N
VASILTY BURKHANOV	55	100.0	N	N	N
VENUS DIAMOND	38	100.0	N	N	N
VINE	133	100.0	N	N	N
VIRGINIA	234	11.5	Y	Y	Y
VISAYAS VICTORY	32	28.1	Y	N	N
VIVA	150	28.0	Y	Y	Y
WADI SUDR	37	64.8	Y	N	N
WALTER J. MCCARTHY	143	74.1	Y	Y	Y
WESTERDAM	46	100.0	N	N	N
WESTERN FRIEND	225	35.1	Y	Y	Y
WESTERN LION	1	100.0	N	N	N
WESTWARD	16	50.0	N	N	L
WESTWARD VENTURE	369	78.0	Y	Y	Y
WESTWOOD ANETTE	162	77.1	Y	Y	Y
WESTWOOD BELINDA	125	49.6	N	N	L
WESTWOOD CLEO	95	61.0	Y	Y	Y
WESTWOOD FUJI	94	88.2	Y	Y	Y
WESTWOOD HALLA	127	63.7	Y	Y	Y
WESTWOOD JAGO	115	68.6	N	N	L
WESTWOOD MARIANNE	165	80.0	Y	Y	Y
WILFRED SYKES	5	60.0	N	N	L
WILLAMETTE	19	57.8	N	N	L
WILLIAM E. CRAIN	288	0.0	N	N	L
WILLIAM E. MUSSMAN	135	40.0	Y	Y	Y
WOLVERINE	122	92.6	Y	Y	Y
YOHFU	129	75.1	Y	Y	Y
YOUNG SPROUT	19	0.0	Y	N	N
YUCATAN	65	18.4	N	N	L
YURIY OSTROVSKIY	134	92.5	Y	Y	N
YUYO BREEZE	39	92.3	Y	Y	Y
ZAGREB EXPRESS	17	100.0	N	N	N
ZENITH	68	100.0	N	N	N
ZETLAND	211	100.0	N	N	N
ZIM AMERICA	61	100.0	N	N	N
ZIM ASIA	2	100.0	N	N	N
ZIM CANADA	47	100.0	N	N	N
ZIM IBERIA	69	100.0	N	N	N
ZIM ISRAEL	73	100.0	N	N	N
ZIM ITALIA	69	100.0	N	N	N
ZIM JAPAN	93	100.0	N	N	N
ZIM KEELUNG	51	100.0	N	N	N
ZIM KOREA	50	100.0	N	N	N
ZIM MONTEVIDEO	2	100.0	N	N	N
ZIM PARAGUAY	191	47.6	Y	Y	Y
GRAND TOTAL	118,365				
TOTAL VIA RADIO	88,419				
PERCENT VIA RADIO	74.7				

NAME	TOTAL OBS	PERCENT VIA RADIO	MANUSCRIPT RECEIVED JUL	AUG	SEP
1ST LT ALEX BONNYMAN	23	39.1	L	L	N
1ST LT BALDOMERO LOPEZ	96	100.0	N	N	N
2ND LT. JOHN P. BOBO	50	98.0	L	N	N
A. V. KASTNER	60	100.0	N	N	N
ACACIA	23	78.2	L	N	N
ACADIA FOREST	102	33.3	Y	N	N
ACT 7	187	100.0	N	N	N
ACT I	140	100.0	N	N	N
ADAM E. CORNELIUS	126	69.0	L	N	N
ADDIRIYAH	153	73.2	Y	Y	Y
ADVANTAGE	16	100.0	N	N	N
AFFINITY	4	100.0	N	N	N
AL AWDAH	332	100.0	N	N	N
AL SAMIDOON	211	100.0	N	N	N
AL SHUHADAA	108	100.0	N	N	N
AL WATTAYAH	101	79.2	L	N	N
ALASKA	3	100.0	N	N	N
ALBEMARLE ISLAND	50	92.0	L	N	N
ALBERNI DAWN	29	100.0	N	N	N
ALDEN W. CLAUSEN	32	53.1	Y	N	N
ALLIGATOR AMERICA	105	100.0	N	N	N
ALLIGATOR BRAVERY	150	88.0	Y	Y	Y
ALLIGATOR COLUMBUS	115	42.6	Y	Y	Y
ALLIGATOR GLORY	53	92.4	L	N	N
ALLIGATOR LIBERTY	136	100.0	N	N	N
ALLIGATOR STRENGTH	180	51.1	Y	Y	Y
ALLIGATOR VICTORY	30	96.6	L	N	N
ALMANIA	40	82.5	Y	Y	Y
ALMERIA LYKES	61	78.6	Y	Y	Y
ALPENA	56	85.7	L	N	N
ALPHA HELIX	45	55.5	L	L	N
ALTAMONTE	21	100.0	N	N	N
AMALIA	104	12.5	L	L	N
AMAZON	73	94.5	L	N	N
AMBASSADOR	23	65.2	Y	N	N
AMBASSADOR BRIDGE	77	72.7	Y	Y	Y
AMER HIMALAYA	11	100.0	N	N	N
AMERICA STAR	226	100.0	N	N	N
AMERICAN CONDOR	242	9.5	Y	Y	Y
AMERICAN CORMORANT	16	100.0	N	N	N
AMERICAN FALCON	53	33.9	L	L	N
AMERICAN OSPREY	28	100.0	N	N	N
AMERICANA	57	98.2	L	N	N
AMERIGO VESPUCCI	13	100.0	N	N	N
ANASTASIS	32	100.0	N	N	N
ANATOLIY KOLESNICHENKO	12	100.0	N	N	N
ANDERS MAERSK	167	48.5	Y	Y	Y
ANGELA	116	83.6	L	N	N
ANNA MAERSK	133	74.4	Y	Y	N
AOMORI WILLOW	37	100.0	N	N	N
APL CHINA	140	92.1	L	N	N
APL JAPAN	88	96.5	L	N	N
APL KOREA	85	84.7	Y	Y	N
APL PHILIPPINES	143	19.5	L	L	N
APL SINGAPORE	91	96.7	Y	Y	Y
ARABELLA	203	13.3	Y	Y	Y
ARABIAN SEA	54	20.3	L	L	N
ARABIAN SENATOR	107	100.0	N	N	N
ARCO ALASKA	71	0.0	Y	Y	Y
ARCO CALIFORNIA	33	72.7	Y	N	N
ARCO FAIRBANKS	21	100.0	N	N	N
ARCO INDEPENDENCE	19	63.1	Y	N	N
ARCO SAG RIVER	26	100.0	N	N	N
ARCO SPIRIT	71	46.4	Y	N	N
ARCO TEXAS	12	8.3	Y	N	N
ARCTIC SUN	141	51.7	Y	Y	Y

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NAME	TOTAL OBS	PERCENT VIA RADIO	MANUSCRIPT RECEIVED JUL	AUG	SEP
ARCTIC UNIVERSAL	101	100.0	N	N	N
ARGONAUT	67	28.3	Y	Y	Y
ARIES	11	81.8	L	N	N
ARKONA	9	100.0	N	N	N
ARKTIS LIGHT	96	80.2	L	N	N
ARMCO	111	97.2	Y	Y	Y
ARTHUR M. ANDERSON	246	89.0	Y	Y	Y
ARTHUR MAERSK	169	77.5	Y	Y	Y
ATLANTA BAY	58	100.0	N	N	N
ATLANTIC	671	100.0	N	N	N
ATLANTIC BULKER	160	0.0	Y	Y	Y
ATLANTIC COMPANION	68	100.0	N	N	N
ATLANTIC COMPASS	91	100.0	N	N	N
ATLANTIC CONCERT	63	100.0	N	N	N
ATLANTIC CONVEYOR	36	100.0	N	N	N
ATLANTIC HURON	187	100.0	N	N	N
ATLANTIC SUPERIOR	153	100.0	N	N	N
AUCKLAND STAR	81	100.0	N	N	N
AUSTRAL RAINBOW	11	27.2	L	L	N
AUTHOR	109	100.0	N	N	N
AXEL MAERSK	161	60.2	Y	Y	Y
B.T. ALASKA	18	100.0	N	N	N
BANDA SEAHORSE	206	69.9	Y	Y	Y
BAR' ZAN	38	26.3	L	L	N
BARBARA ANDRIE	68	79.4	L	N	N
BARRINGTON ISLAND	150	93.3	L	N	N
BAUCHI	55	98.1	Y	N	N
BAY BRIDGE	118	11.8	Y	Y	Y
BELGRANO	100	73.0	Y	N	N
BERING SEA	130	88.4	L	N	N
BERNARDO QUINTANA A	160	96.8	Y	Y	Y
BLEST FUTURE	67	62.6	L	N	N
BOHINJ	23	26.0	Y	N	N
BONN EXPRESS	125	100.0	N	N	N
BOSPORUS BRIDGE	158	75.9	L	N	N
BOW TRIGGER	85	100.0	N	N	N
BP ADMIRAL	5	100.0	N	N	N
BREMEN EXPRESS	101	100.0	N	N	N
BRIGHT PHOENIX	205	95.1	Y	Y	Y
BRISBANE STAR	178	100.0	N	N	N
BRITISH ADVENTURE	112	100.0	N	N	N
BRITISH RANGER	213	100.0	N	N	N
BROOKLYN BRIDGE	213	91.5	Y	Y	Y
BRUCE SMART	154	3.8	Y	Y	Y
BT NIMROD	69	100.0	N	N	N
BUCKEYE	280	86.0	L	N	N
BUNGA KANTAN	1	100.0	N	N	N
BUNGA KESIDANG	10	100.0	N	N	N
BUNGA ORKID DUA	191	91.0	L	N	N
BUNGA SAGA TIGA	128	73.4	Y	Y	Y
BURNS HARBOR	430	87.9	L	N	N
CALCITE II	186	89.2	Y	Y	Y
CALIFORNIA CURRENT	162	100.0	N	N	N
CALIFORNIA HERMES	90	7.7	Y	N	N
CALIFORNIA LUNA	82	100.0	N	N	N
CALIFORNIA MERCURY	37	100.0	N	N	N
CALIFORNIA ORION	1	100.0	N	N	N
CALIFORNIA PEGASUS	61	100.0	N	N	N
CALIFORNIA SATURN	62	88.7	L	N	N
CALIFORNIA TRITON	58	75.8	L	N	N
CALIFORNIA ZEUS	104	94.2	L	N	N
CAPE BREEZE	201	97.0	Y	Y	Y
CAPE CHARLES	63	100.0	N	N	N
CAPE HENRY	35	97.1	L	N	N
CAPE INTREPID	29	31.0	Y	N	N
CAPE MAY	113	100.0	N	N	N
CAPE WRATH	7	100.0	N	N	N
CAPTAIN LEE	69	100.0	N	N	N
CARDIGAN BAY	146	100.0	N	N	N
CARLA A. HILLS	173	69.3	Y	Y	Y
CARMEL	15	100.0	N	N	N
CAROLA E	13	100.0	N	N	N
CASON J. CALLAWAY	280	84.2	Y	Y	Y
CCNI ATACAMA	32	100.0	N	N	N
CELEBRATION	44	81.8	Y	Y	Y
CELTIC SEA	30	70.0	L	N	N
CENTURY HIGHWAY #2	1	100.0	N	N	N
CENTURY HIGHWAY NO. 1	42	100.0	N	N	N
CENTURY HIGHWAY_NO. 3	15	100.0	N	N	N
CENTURY LEADER NO. 1	110	100.0	N	N	N
CGM PROVENCE	142	100.0	N	N	N
CHAITEN	140	48.5	Y	Y	N
CHARLES ISLAND	38	94.7	L	N	N
CHARLES LYKES	166	100.0	N	N	N
CHARLES M. BEEGHLEY	47	95.7	Y	N	N
CHARLES PIGOTT	230	0.0	Y	Y	N
CHASTINE MAERSK	166	63.8	Y	Y	Y
CHC NO.1	3	100.0	N	N	N
CHEMBULK FORTITUDE	30	83.3	L	N	N
CHEMICAL PIONEER	123	86.9	Y	Y	Y
CHEMICAL RUBI	33	100.0	N	N	N
CHESAPEAKE TRADER	30	100.0	N	N	N
CHEVRON ARIZONA	74	83.7	Y	N	N
CHEVRON ATLANTIC	128	0.0	L	L	L
CHEVRON COLORADO	143	92.3	Y	Y	Y
CHEVRON EDINBURGH	206	61.6	Y	Y	Y
CHEVRON EMPLOYEE PRIDE	201	14.4	L	L	N
CHEVRON MARINER	88	0.0	Y	N	N
CHEVRON MISSISSIPPI	143	86.7	Y	Y	Y
CHEVRON OREGON	12	41.6	L	L	N
CHEVRON PERTH	52	100.0	N	N	N
CHEVRON SOUTH AMERICA	128	44.5	L	L	N
CHIEF GADAO	134	64.9	Y	Y	Y
CHILEAN EXPRESS	42	100.0	N	N	N
CHINA HOPE	31	100.0	N	N	N
CHIQUITA BARACOA	229	100.0	N	N	N
CHIQUITA BARU	214	100.0	N	N	N
CHIQUITA BELGIE	144	100.0	N	N	N
CHIQUITA BREMEN	1	100.0	N	N	N
CHIQUITA BRENDA	175	100.0	N	N	N
CHIQUITA DEUTSCHLAND	148	100.0	N	N	N
CHIQUITA ELKESCHLAND	91	100.0	N	N	N
CHIQUITA FRANCES	173	100.0	N	N	N
CHIQUITA ITALIA	138	100.0	N	N	N
CHIQUITA JEAN	155	100.0	N	N	N
CHIQUITA JOY	173	100.0	N	N	N
CHIQUITA NEDERLAND	163	100.0	N	N	N
CHIQUITA SCANDINAVIA	182	100.0	N	N	N
CHIQUITA SCHWEIZ	147	100.0	N	N	N
CHOAPA	116	91.3	Y	Y	N
CHOYANG PRIDE	175	100.0	N	N	N
CHOYANG VISION	148	16.8	L	L	N
CHRISTIANE	110	74.5	Y	Y	N
CHUN HO	92	80.4	Y	N	N
CIELO DI FIRENZE	2	100.0	N	N	N
CITY OF DURBAN	141	100.0	N	N	N
CLEVELAND	37	18.9	Y	N	N
CLIFFORD MAERSK	93	80.6	Y	Y	Y
CMS ISLAND EXPRESS	60	0.0	Y	Y	Y
COLUMBIA BAY	124	100.0	N	N	N
COLUMBIA STAR	368	95.1	L	N	N
COLUMBINE	311	79.4	Y	Y	Y

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NAME	TOTAL OBS	PERCENT VIA RADIO	MANUSCRIPT RECEIVED JUL	AUG	SEP
COLUMBUS AMERICA	420	100.0	N	N	N
COLUMBUS CALIFORNIA	191	100.0	N	N	N
COLUMBUS CANADA	308	100.0	N	N	N
COLUMBUS OLIVOS	13	100.0	N	N	N
COLUMBUS QUEENSLAND	105	100.0	N	N	N
COLUMBUS VICTORIA	267	100.0	N	N	N
CONDOLEEZZA RICE	10	100.0	N	N	N
CONTIENTAL WING	69	100.0	N	N	N
CONTSHIP AMERICA	15	100.0	N	N	N
CONTSHIP ENGLAND	43	100.0	N	N	N
CONTSHIP FRANCE	31	54.8	L	L	N
COPACABANA	93	65.5	Y	Y	N
CORAL HIGHWAY	95	100.0	N	N	N
CORMORANT ARROW	55	58.1	Y	Y	N
CORNELIA MAERSK	43	9.3	Y	Y	Y
CORNUCOPIA	79	83.5	Y	Y	N
CORONADO	15	100.0	N	N	N
CORWITH CRAMER	8	62.5	L	N	N
COSMIC CHALLENGER	54	100.0	N	N	N
COSMIC MASTER	117	99.1	L	N	N
COSMOWAY	27	66.6	L	N	N
COURAGEOUS	45	0.0	L	L	L
COURIER	43	100.0	N	N	N
COURTNEY BURTON	188	87.7	Y	Y	Y
COURTNEY L	70	88.5	Y	Y	N
CPL. LOUIS J. HAUGE JR	12	75.0	L	N	N
CRANE PACIFIC	41	95.1	Y	Y	N
CRISTINA 1	26	42.3	L	L	N
CRISTOFORO COLOMBO	30	56.6	L	L	N
CROATIA EXPRESS	6	100.0	N	N	N
CROWN OF SCANDINAVIA	331	100.0	N	N	N
CSK UNITY	62	100.0	N	N	N
CSL ATLAS	50	100.0	N	N	N
CSL CABO	56	100.0	N	N	N
CSS HUDSON	179	100.0	N	N	N
CTE ALGECIRAS	17	94.1	Y	N	N
DAGMAR MAERSK	101	100.0	N	N	N
DAN MOORE	2	100.0	N	N	N
DAVID Z. NORTON	5	100.0	N	N	N
DEL MONTE CONSUMER	109	0.0	Y	Y	Y
DEL MONTE PACKER	71	94.3	Y	Y	Y
DEL MONTE TRADER	193	50.7	Y	Y	Y
DELAWARE TRADER	340	72.3	Y	Y	Y
DELMONTE PLANTER	32	34.3	Y	Y	Y
DELMONTE TRANSPORTER	22	100.0	N	N	N
DENALI	180	66.6	L	N	N
DEPPE FLORIDA	82	100.0	N	N	N
DG COLUMBIA	229	69.4	Y	Y	Y
DIAMOND STAR	27	100.0	N	N	N
DIRCH MAERSK	38	55.2	L	N	N
DIRECT EAGLE	92	100.0	N	N	N
DIRECT FALCON	156	95.5	Y	N	N
DIRECT KEA	208	100.0	N	N	N
DIRECT KIWI	234	50.4	L	N	N
DIRECT KOOKABURRA	199	30.6	Y	Y	Y
DOCK EXPRESS 10	65	100.0	N	N	N
DOCK EXPRESS 20	39	100.0	N	N	N
DOCTOR LYKES	125	47.2	L	L	N
DOROTHEA OLDENDORFF	100	32.0	Y	N	N
DORTHE OLDENDORFF	169	85.7	Y	Y	Y
DOUBLE GLORY	25	100.0	N	N	N
DRYSO	40	100.0	N	N	N
DSR BALTIC	67	100.0	N	N	N
DSR EUROPE	147	100.0	N	N	N
DSR PACIFIC	123	100.0	N	N	N
DUBROVNIK EXPRESS	21	100.0	N	N	N
DUHALLOW	279	100.0	N	N	N
DUNCAN ISLAND	118	93.2	Y	N	N
DUSSELDORF EXPRESS	892	100.0	N	N	N
E.P. LE QUEBECOIS	672	100.0	N	N	N
EARL W. OGLEBAY	6	100.0	N	N	N
EASTERN LION	174	100.0	N	N	N
ECSTASY	1	100.0	N	N	N
EDELWIESS	109	77.0	L	N	N
EDGAR B. SPEER	206	89.8	L	N	N
EDWIN H. GOTT	374	90.6	L	N	N
EDYTH L	72	100.0	N	N	N
ELISABETH OLDENDORFF	1	100.0	N	N	N
ELISE SHULTE	16	0.0	Y	N	N
ELLEN KNUDSEN	30	63.3	L	N	N
ELLENSBORG	49	0.0	Y	N	N
ELLIOTT BAY	189	84.1	Y	Y	Y
ELSBERG	268	8.5	Y	Y	Y
ENIF	165	100.0	N	N	N
EVER GAINING	9	100.0	N	N	N
EVER GARLAND	12	100.0	N	N	N
EVER GATHER	3	100.0	N	N	N
EVER GENIUS	5	100.0	N	N	N
EVER GENTLE	14	100.0	N	N	N
EVER GENTRY	23	100.0	N	N	N
EVER GLEAMY	4	100.0	N	N	N
EVER GLEEFUL	9	100.0	N	N	N
EVER GOLDEN	15	100.0	N	N	N
EVER GOVERN	4	100.0	N	N	N
EVER GRACE	29	0.0	L	L	L
EVER GRADE	17	100.0	N	N	N
EVER GUARD	6	100.0	N	N	N
EVER GUIDE	21	100.0	N	N	N
EVER RENOWN	11	0.0	L	N	N
EVER REPUTE	9	55.5	L	N	N
EVER RESULT	69	46.3	Y	Y	Y
EVER RIGHT	6	100.0	N	N	N
EVER ROUND	25	100.0	N	N	N
EWL VENEZUELA	644	100.0	N	N	N
EXCELSIOR	258	100.0	N	N	N
EXEMPLAR	176	100.0	N	N	N
EXPORT FREEDOM	117	50.4	Y	Y	Y
EXPORT PATRIOT	123	41.4	Y	Y	Y
FAIRLIFT	120	100.0	N	N	N
FAIRMAST	59	100.0	N	N	N
FALSTRIA	130	100.0	N	N	N
FANTASY	36	16.6	Y	Y	Y
FARALLON ISLAND	295	100.0	N	N	N
FASCINATION	39	61.5	Y	Y	Y
FAUST	73	52.0	L	N	N
FERNCROFT	89	70.7	L	N	N
FETISH	27	100.0	N	N	N
FIDELIO	140	41.4	Y	Y	N
FIGARO	86	93.0	Y	Y	N
FIORA TOPIC	1	100.0	N	N	N
FIR GROVE	41	100.0	N	N	N
FLAMENGO	42	100.0	N	N	N
FOREST CHAMPION	37	100.0	N	N	N
FOREST TRADER	102	58.8	L	N	N
FRANCES HAMMER	202	50.0	L	L	N
FRANCES L	42	95.2	Y	N	N
FRANKFURT EXPRESS	45	100.0	N	N	N
FRED R. WHITE JR	83	87.9	L	N	N
FULL COMFORT	134	73.8	Y	Y	N
GALVESTON BAY	87	39.0	Y	Y	Y
GENEVIEVE LYKES	2	100.0	N	N	N
GEORGE A. SLOAN	330	69.0	Y	Y	Y

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NAME	TOTAL OBS	PERCENT VIA RADIO	MANUSCRIPT RECEIVED JUL	AUG	SEP
GEORGE A. STINSON	7	28.5	L	L	N
GEORGE H. WEYERHAEUSER	20	100.0	N	N	N
GEORGE SCHULTZ	85	61.1	L	N	N
GEORGE WASHINGTON BRID	160	100.0	N	N	N
GEORGIA RAINBOW II	123	81.3	L	N	N
GERMAN SENATOR	26	100.0	N	N	N
GERONIMO	24	41.6	L	L	N
GINGA MARU	91	100.0	N	N	N
GLOBAL LINK	18	0.0	L	L	L
GLOBAL MARINER	33	66.6	Y	Y	N
GLOBAL SENTINEL	159	37.7	L	L	N
GLORIOUS SUCCESS	58	91.3	Y	Y	Y
GLORIOUS SUN	183	91.8	Y	Y	Y
GOLDEN APO	18	27.7	L	L	N
GOLDEN GATE	46	82.6	L	N	N
GOLDEN GATE BRIDGE	144	97.2	Y	Y	Y
GOPHER STATE	100	100.0	N	N	N
GREAT LAND	31	93.5	L	N	N
GREEN BAY	215	34.4	L	L	N
GREEN HARBOUR	15	100.0	N	N	N
GREEN ISLAND	82	63.4	L	N	N
GREEN LAKE	344	38.3	Y	Y	N
GREEN MAYA	14	100.0	N	N	N
GREEN RAINIER	55	25.4	L	L	N
GREEN RIDGE	88	45.4	Y	Y	Y
GREEN SASEBO	10	0.0	L	N	N
GREEN SYLVAN	53	100.0	N	N	N
GREEN VALLEY	75	49.3	Y	N	N
GRETKE OLDENDORFF	54	66.6	L	N	N
GROTON	132	95.4	Y	Y	Y
GROWTH RING	92	100.0	N	N	N
GUANAJUATO	24	100.0	N	N	N
GUAYAMA	204	35.7	Y	Y	Y
GULF CURRENT	201	100.0	N	N	N
GULF SPIRIT	37	100.0	N	N	N
GYN YOH	69	94.2	Y	Y	Y
GYPSUM BARON	147	100.0	N	N	N
GYPSUM KING	114	100.0	N	N	N
H. LEE WHITE	38	100.0	N	N	N
HANDY BRAVE	46	2.1	Y	Y	N
HANJIN BARCELONA	37	100.0	N	N	N
HANJIN BREMEN	19	63.1	L	N	N
HANJIN COLOMBO	23	100.0	N	N	N
HANJIN ELIZABETH	11	100.0	N	N	N
HANJIN FELIXSTOWE	15	100.0	N	N	N
HANJIN HONG KONG	23	100.0	N	N	N
HANJIN KAOHSIUNG	11	100.0	N	N	N
HANJIN KEELUNG	1	100.0	N	N	N
HANJIN KOBE	8	100.0	N	N	N
HANJIN LE HAVRE	20	100.0	N	N	N
HANJIN MARSEILLES	43	100.0	N	N	N
HANJIN OAKLAND	14	100.0	N	N	N
HANJIN OSAKA	1	100.0	N	N	N
HANJIN PORTLAND	31	100.0	N	N	N
HANJIN ROTTERDAM	19	68.4	L	N	N
HANJIN SEATTLE	27	100.0	N	N	N
HANJIN SHANGHAI	34	91.1	Y	N	N
HANJIN SINGAPORE	7	100.0	N	N	N
HANJIN TOKYO	30	100.0	N	N	N
HANJIN VANCOUVER	15	100.0	N	N	N
HANNAH D. HANNA	5	20.0	L	L	N
HARBOUR BRIDGE	128	60.1	Y	Y	Y
HAVELLAND	115	44.3	Y	Y	Y
HEICON	55	34.5	L	L	N
HEIDELBERG EXPRESS	223	100.0	N	N	N
HELVETIA	36	88.8	L	N	N
HENRY HUDSON BRIDGE	180	99.4	L	N	N
HERBERT C. JACKSON	102	92.1	Y	Y	Y
HESIOD	215	100.0	N	N	N
HOEGH CLIPPER	33	51.5	Y	N	N
HOEGH DRAKE	179	18.9	Y	Y	N
HOEGH DUKE	28	42.8	L	L	N
HOEGH DYKE	14	100.0	N	N	N
HOEGH MERIT	136	54.4	Y	Y	Y
HOEGH MINERVA	21	28.5	L	L	N
HOLCK LARSEN	8	100.0	N	N	N
HOOD ISLAND	50	100.0	N	N	N
HOUSTON EXPRESS	278	100.0	N	N	N
HOWELL LYKES	32	28.1	Y	N	N
HUAL CARMENCITA	2	100.0	N	N	N
HUAL INGRITA	16	56.2	L	N	N
HUMACAO	229	45.8	Y	Y	Y
HYUNDAI DUKE	26	100.0	N	N	N
HYUNDAI DYNASTY	95	100.0	N	N	N
HYUNDAI INDEPENDENCE	14	100.0	N	N	N
HYUNDAI LIBERTY	4	100.0	N	N	N
HYUNDAI LONGVIEW	150	98.0	Y	N	N
HYUNDAI PORTLAND	30	100.0	N	N	N
HYUNDAI TACOMA	176	85.2	Y	N	N
IGARKA	18	100.0	N	N	N
IMAGINATION	48	85.4	Y	N	N
INDIANA HARBOR	172	88.9	L	N	N
INLAND SEAS	29	51.7	L	N	N
INSPIRATION	119	46.2	Y	Y	Y
IOWA TRADER	18	94.4	Y	N	N
ISLA GRAN MALVINA	5	100.0	N	N	N
ISLAND BREEZE	12	100.0	N	N	N
ISLAND PRINCESS	6	100.0	N	N	N
ITB BALTIMORE	103	87.3	Y	Y	Y
ITB MOBILE	160	88.7	Y	Y	Y
ITB NEW YORK	38	0.0	Y	N	N
IVER EXPLORER	33	100.0	N	N	N
IVER EXPRESS	65	100.0	N	N	N
IWANUMA MARU	181	30.9	Y	Y	Y
J. DENNIS BONNEY	26	100.0	N	N	N
JACKSONVILLE	184	96.1	Y	Y	Y
JADE ORIENT	26	100.0	N	N	N
JADE PACIFIC	22	100.0	N	N	N
JAHRE SPIRIT	29	100.0	N	N	N
JALAGOVIND	3	100.0	N	N	N
JAMES LYKES	23	100.0	N	N	N
JAMES R. BARKER	201	95.0	L	N	N
JAPAN RAINBOW 2	201	37.3	Y	Y	Y
JAPAN SENATOR	12	100.0	N	N	N
JASMINE	52	100.0	N	N	N
JEAN LYKES	120	25.8	L	L	N
JEBEL ALI	96	64.5	Y	N	N
JOHN G. MUNSON	236	91.9	Y	Y	Y
JOHN J. BOLAND	149	86.5	Y	Y	Y
JOHN YOUNG	252	0.0	L	L	L
JOSEPH H. FRANTZ	108	87.9	Y	Y	Y
JOSEPH L. BLOCK	155	76.1	L	N	N
JOSEPH LYKES	59	100.0	N	N	N
JUBILANT	141	12.0	L	L	L
JUBILEE	84	83.3	L	N	N
JULIUS HAMMER	198	35.3	L	L	N
JUPITER DIAMOND	28	100.0	N	N	N
KAHO	8	0.0	L	N	N
KAIJIN	107	93.4	Y	Y	N
KANSAS TRADER	25	100.0	N	N	N
KAPITAN BOCHEK	1	100.0	N	N	N
KAPITAN BYANKIN	146	93.8	Y	Y	Y

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NAME	TOTAL OBS	PERCENT VIA RADIO	MANUSCRIPT RECEIVED JUL	AUG	SEP
KAPITAN GNEZPILOV	54	100.0	N	N	N
KAPITAN KONEV	220	93.6	Y	Y	Y
KAPITAN MAN	115	100.0	N	N	N
KAPITAN SERYKH	84	96.4	Y	Y	Y
KAREN ANDRIE	34	17.6	L	L	N
KAUAI	228	92.5	Y	Y	Y
KAYE E. BARKER	233	91.8	L	N	N
KAZIMAH	254	100.0	N	N	N
KEE LUNG	34	100.0	N	N	N
KEMEROVO	26	100.0	N	N	N
KEN SHO	15	100.0	N	N	N
KENAI	8	100.0	N	N	N
KENNETH E. HILL	127	59.8	Y	Y	N
KENNETH T. DERR	83	74.6	Y	Y	Y
KENTUCKY HIGHWAY	47	100.0	N	N	N
KINSMAN INDEPENDENT	285	84.2	L	N	N
KITTANING	29	100.0	N	N	N
KNOCK ALLAN	19	100.0	N	N	N
KNORR	35	100.0	N	N	N
KOELN EXPRESS	328	100.0	N	N	N
KOMET	115	76.5	Y	Y	Y
KOMSOMOLETS PRIMORYA	8	100.0	N	N	N
KURE	73	34.2	L	L	N
LA TRINITY	63	93.6	Y	Y	Y
LAKE GUARDIAN	42	90.4	L	N	N
LAWRENCE H. GIANELLA	53	92.4	Y	N	N
LEE A. TREGURTHA	41	95.1	L	N	N
LEGEND OF THE SEAS	119	83.1	L	N	N
LEON	24	100.0	N	N	N
LEONARD J. COWLEY	19	100.0	N	N	N
LEONIA	57	100.0	N	N	N
LIBERTY STAR	101	57.4	Y	Y	Y
LIBERTY SUN	115	53.9	Y	Y	N
LIBERTY VICTORY	68	36.7	Y	Y	Y
LIHUE	60	43.3	L	L	N
LINDA OLDENDORF	196	68.3	Y	Y	N
LIRCAY	126	92.8	L	N	N
LNG AQUARIUS	134	32.8	Y	Y	N
LNG CAPRICORN	3	100.0	N	N	N
LNG LEO	75	61.3	Y	Y	Y
LNG LIBRA	33	100.0	N	N	N
LNG TAURUS	95	53.6	Y	Y	Y
LNG VIRGO	69	59.4	L	N	N
LONDON ENTERPRISE	35	100.0	N	N	N
LONDON SPIRIT	174	100.0	N	N	N
LONG BEACH	166	82.5	L	N	N
LOOTSGRACHT	1	100.0	N	N	N
LOS ANGELES	40	100.0	N	N	N
LT ARGOSY	156	33.9	L	L	N
LT PRAGATI	26	100.0	N	N	N
LT. ODYSSEY	22	100.0	N	N	N
LTC CALVIN P. TITUS	13	92.3	Y	N	N
LUCKY	18	100.0	N	N	N
LUCKY BULKER	106	100.0	N	N	N
LUCKY GRACE	201	11.9	Y	Y	Y
LUNA MAERSK	203	79.3	Y	Y	Y
LURLINE	96	79.1	L	N	N
MACKINAC BRIDGE	195	98.4	L	N	N
MADISON MAERSK	104	39.4	Y	Y	Y
MAERSK CHARLESTON	1	100.0	N	N	N
MAERSK CONSTELLATION	80	73.7	Y	Y	Y
MAERSK ENDEAVOUR	533	100.0	N	N	N
MAERSK EXPLORER	498	100.0	N	N	N
MAERSK GANNET	187	100.0	N	N	N
MAERSK GIANT	42	100.0	N	N	N
MAERSK LA PAZ	191	49.2	Y	Y	Y
MAERSK SAO PAOLO	179	100.0	N	N	N
MAERSK SHETLAND	67	100.0	N	N	N
MAERSK SOMERSET	156	96.1	Y	N	N
MAERSK STAFFORD	84	100.0	N	N	N
MAERSK TANJONG	67	100.0	N	N	N
MAGIC	183	60.6	Y	Y	Y
MAGLEBY MAERSK	119	71.4	Y	Y	Y
MAHARASHTRA	141	94.3	Y	Y	N
MAHIMAHI	175	80.0	Y	Y	Y
MAIRANGI BAY	213	100.0	N	N	N
MAJ STEPHEN W PLESS MP	27	100.0	N	N	N
MAJESTIC MAERSK	102	20.5	Y	Y	Y
MALCOLM BALDRIGE	219	91.7	Y	Y	N
MANGAL DESAI	161	40.9	Y	Y	Y
MANHATTAN BRIDGE	148	69.5	Y	Y	Y
MANOA	294	95.5	Y	Y	Y
MANUKAI	168	44.6	Y	Y	Y
MANULANI	183	41.5	Y	Y	Y
MARCARRIER	12	100.0	N	N	N
MARCHEN MAERSK	133	72.1	Y	Y	Y
MAREN MAERSK	69	39.1	L	L	N
MARGARET LYKES	133	11.2	Y	Y	Y
MARGRETHE MAERSK	67	23.8	L	L	N
MARIA LAURA	74	100.0	N	N	N
MARIA TOPIC	25	100.0	N	N	N
MARIE MAERSK	102	47.0	Y	Y	Y
MARINE EXPRESS	28	100.0	N	N	N
MARINE RELIANCE	77	45.4	L	L	N
MARIT MAERSK	119	63.0	Y	Y	Y
MARK HANNAH	79	65.8	L	N	N
MARLIN	12	100.0	N	N	N
MARY E. HANNAH	7	100.0	N	N	N
MARY PAGE HANNAH	6	16.6	L	N	N
MATHILDE MAERSK	110	86.3	Y	Y	Y
MATSONIA	222	47.7	Y	Y	Y
MAUI	183	71.0	Y	Y	Y
MAURICE EWING	116	96.5	Y	N	N
MAYAGUEZ	222	66.2	Y	Y	Y
MAYVIEW MAERSK	64	54.6	Y	Y	Y
MC-KINNEY MAERSK	98	60.2	Y	Y	Y
MEARSK NEWARK	33	100.0	N	N	N
MEDALLION	82	95.1	Y	N	N
MEDUSA CHALLENGER	299	86.6	Y	Y	Y
MELBOURNE STAR	216	100.0	N	N	N
MELVILLE	237	25.7	L	L	N
MERCHANT PREMIER	83	100.0	N	N	N
MERCHANT PRINCIPAL	176	100.0	N	N	N
MERIDA	129	100.0	N	N	N
MERIDIAN	44	0.0	Y	Y	Y
MERLION ACE	180	41.6	Y	Y	Y
MESABI MINER	115	94.7	L	N	N
METEOR	645	100.0	N	N	N
METTE MAERSK	92	50.0	Y	Y	Y
MICHIGAN	334	41.3	L	L	N
MIDDLETOWN	77	93.5	Y	Y	Y
MILDBURG	123	100.0	N	N	N
MINERAL OSPREY	15	100.0	N	N	N
MING ASIA	29	65.5	Y	N	N
MING PEACE	25	100.0	N	N	N
MING PLEASURE	114	100.0	N	N	N
MING PROPITIOUS	31	100.0	N	N	N
MITLA	47	91.4	Y	N	N
MOANA PACIFIC	117	100.0	N	N	N
MOKIHANA	243	93.0	Y	Y	Y
MOKU PAHU	87	33.3	L	L	N
MONTERREY	216	93.0	L	N	N

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NAME	TOTAL OBS	PERCENT VIA RADIO	MANUSCRIPT RECEIVED JUL	AUG	SEP
MORELOS	171	98.2	Y	N	N
MORMACSKY	38	60.5	Y	Y	N
MORMACSTAR	48	45.8	Y	N	N
MORMACSUN	85	61.1	Y	Y	Y
MOSEL ORE	205	100.0	N	N	N
MSC JESSICA	184	72.8	L	N	N
MUNKEBO MAERSK	45	100.0	N	N	N
MYRON C. TAYLOR	350	83.7	Y	Y	Y
NATIONAL DIGNITY	37	83.7	Y	Y	Y
NATIONAL HONOR	42	92.8	L	N	N
NATIONAL PRIDE	9	100.0	N	N	N
NAUTICAS MEXICO	75	74.6	L	N	N
NEDLLOYD DELFT	210	100.0	N	N	N
NEDLLOYD HOLLAND	118	100.0	N	N	N
NEDLLOYD RALEIGH BAY	100	100.0	N	N	N
NEDLLOYD VAN CLOON	82	100.0	N	N	N
NEDLLOYD VAN DAJIMA	167	100.0	N	N	N
NEDLLOYD VAN DIEMEN	113	100.0	N	N	N
NEGO LOMBOK	191	100.0	N	N	N
NELVANA	171	76.6	Y	Y	Y
NEPTUNE ACE	79	100.0	N	N	N
NEPTUNE AKABAR	359	0.0	Y	Y	Y
NEPTUNE CRYSTAL	5	100.0	N	N	N
NEPTUNE JADE	51	100.0	N	N	N
NEW CARISSA	282	65.6	Y	Y	Y
NEW HORIZON	74	85.1	Y	Y	Y
NEW NIKKI	194	98.4	Y	Y	Y
NEW YORK SENATOR	120	100.0	N	N	N
NEW YORK SUN	90	88.8	Y	Y	Y
NEWARK BAY	214	100.0	N	N	N
NEWPORT BRIDGE	52	100.0	N	N	N
NOAA DAVID STARR JORDA	87	52.8	Y	Y	Y
NOAA LAUNCH 1107	1	100.0	N	N	N
NOAA SHIP ALBATROSS IV	67	100.0	N	N	N
NOAA SHIP CHAPMAN	453	74.3	Y	Y	Y
NOAA SHIP FERREL	456	94.5	L	N	N
NOAA SHIP KA'IMIMOANA	421	84.7	Y	Y	Y
NOAA SHIP MCARTHUR	569	81.1	Y	Y	Y
NOAA SHIP MILLER FREEM	554	69.4	Y	Y	Y
NOAA SHIP OREGON II	486	85.8	Y	Y	Y
NOAA SHIP RAINIER	255	73.7	Y	Y	Y
NOAA SHIP T. CROMWELL	293	100.0	N	N	N
NOAA SHIP WHITING	337	96.7	Y	Y	Y
NOBEL STAR	35	100.0	N	N	N
NOBLEZA	35	65.7	L	N	N
NOL DELPHI	161	100.0	N	N	N
NOL DIAMOND	2	100.0	N	N	N
NOL RISSO	82	100.0	N	N	N
NOL RUBY	67	100.0	N	N	N
NOL STENO	115	100.0	N	N	N
NOL TOPAZ	24	100.0	N	N	N
NOL ZIRCON	5	100.0	N	N	N
NOMZI	485	85.3	Y	Y	Y
NORASIA SHANGHAI	9	100.0	N	N	N
NORD JAHRE TRANSPORTER	4	100.0	N	N	N
NORD PARTNER	109	83.4	Y	Y	N
NORDIC EMPRESS	33	78.7	Y	Y	Y
NORDMAX	96	100.0	N	N	N
NORTHERN LIGHTS	249	71.0	Y	Y	Y
NORTHERN LION	94	100.0	N	N	N
NORWAY	24	41.6	L	L	N
NOSAC EXPRESS	23	91.3	L	N	N
NOSAC GALAXY	23	100.0	N	N	N
NOSAC TANABATA	9	100.0	N	N	N
NTABENI	145	100.0	N	N	N
NUERNBERG EXPRESS	353	100.0	N	N	N
NUEVO LEON	52	100.0	N	N	N
NUEVO SAN JUAN	213	53.0	Y	Y	Y
NYK SEABREEZE	83	100.0	N	N	N
NYK SPRINGTIDE	65	100.0	N	N	N
NYK STARLIGHT	49	100.0	N	N	N
NYK SUNRISE	141	100.0	N	N	N
NYK SURFWIND	45	100.0	N	N	N
OBO BASAK	15	0.0	L	L	L
OBO ENGIN	2	100.0	N	N	N
OCEAN JADE	143	62.2	Y	N	N
OCEAN LAUREL	34	97.0	L	N	N
OCEAN ORCHID	10	90.0	L	N	N
OCEAN SERENE	50	86.0	L	N	N
OCEANBREEZE	48	95.8	L	N	N
OJI PIONEER	276	45.2	Y	Y	Y
OLEANDER	156	86.5	L	N	N
OLIVEBANK	115	100.0	N	N	N
OLYMPIAN HIGHWAY	7	100.0	N	N	N
OMI COLUMBIA	48	83.3	Y	N	N
OOCL AMERICA	92	76.0	Y	Y	Y
OOCL BRAVERY	72	100.0	N	N	N
OOCL CALIFORNIA	67	74.6	L	N	N
OOCL CHINA	192	94.2	Y	Y	Y
OOCL ENVOY	12	100.0	N	N	N
OOCL FAIR	62	100.0	N	N	N
OOCL FAME	70	100.0	N	N	N
OOCL FIDELITY	98	89.7	L	N	N
OOCL FORTUNE	87	100.0	N	N	N
OOCL FREEDOM	155	100.0	N	N	N
OOCL FRIENDSHIP	60	100.0	N	N	N
OOCL FRONTIER	77	100.0	N	N	N
OOCL HONG KONG	125	98.4	Y	N	N
OOCL INNOVATION	65	100.0	N	N	N
OOCL INSPIRATION	248	87.0	Y	Y	Y
OOCL JAPAN	181	100.0	N	N	N
ORANGE WAVE	94	0.0	L	L	L
OREGON RAINBOW III	175	29.1	L	L	N
ORIENTE GRACE	106	94.3	Y	Y	Y
ORIENTE NOBLE	148	28.3	Y	Y	Y
ORIENTE PRIME	36	72.2	L	N	N
ORION HIGHWAY	133	78.9	L	N	N
OURO DO BRASIL	24	75.0	L	N	N
OVERSEAS ALASKA	40	67.5	L	N	N
OVERSEAS CHICAGO	49	53.0	L	N	N
OVERSEAS HARRIET	62	100.0	N	N	N
OVERSEAS JOYCE	160	67.5	Y	Y	N
OVERSEAS JUNEAU	88	0.0	L	L	L
OVERSEAS MARILYN	146	41.7	Y	Y	Y
OVERSEAS NEW ORLEANS	46	100.0	N	N	N
OVERSEAS NEW YORK	50	62.0	Y	N	N
OVERSEAS OHIO	34	64.7	L	N	N
OVERSEAS WASHINGTON	37	100.0	N	N	N
PACASIA	239	48.1	Y	Y	Y
PACDUKE	45	100.0	N	N	N
PACIFIC HIRO	142	57.7	L	N	N
PACIFIC HOPE	255	98.4	Y	Y	N
PACIFIC PRINCESS	57	100.0	N	N	N
PACIFIC RAINBOW II	198	50.5	Y	Y	Y
PACIFIC WAVE	159	100.0	N	N	N
PACMERCHANT	36	100.0	N	N	N
PACPRINCE	24	100.0	N	N	N
PACPRINCESS	17	100.0	N	N	N
PACQUEEN	78	100.0	N	N	N
PACSEA	42	100.0	N	N	N
PATRIOT	81	100.0	N	N	N
PAUL BUCK	47	100.0	N	N	N

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NAME	TOTAL OBS	PERCENT VIA RADIO	MANUSCRIPT RECEIVED JUL	AUG	SEP
PAUL R. TREGURTHA	356	96.3	L	N	N
PEARL WAVE	32	100.0	N	N	N
PEGGY DOW	32	100.0	N	N	N
PFC EUGENE A. OBREGON	71	80.2	L	N	N
PFC WILLIAM B. BAUGH	7	100.0	N	N	N
PHAROS	164	100.0	N	N	N
PHILADELPHIA	143	0.0	L	L	L
PHILIP R. CLARKE	219	88.5	Y	Y	Y
PHOENIX DIAMOND	30	100.0	N	N	N
PIERRE FORTIN	22	100.0	N	N	N
PINO GLORIA	176	24.4	Y	Y	Y
PISCES EXPLORER	19	100.0	N	N	N
PISCES PIONEER	139	100.0	N	N	N
PISCES PLANTER	89	100.0	N	N	N
POLAR EAGLE	122	27.8	Y	Y	Y
POLYNESIA	171	94.7	L	N	N
POROS	6	100.0	N	N	N
POTOMAC TRADER	22	100.0	N	N	N
POYANG	146	100.0	N	N	N
PRESIDENT ADAMS	128	92.9	Y	Y	Y
PRESIDENT EISENHOWER	171	55.5	L	N	N
PRESIDENT F. ROOSEVELT	139	66.1	L	N	N
PRESIDENT JACKSON	178	62.3	Y	Y	Y
PRESIDENT JEFFERSON	4	100.0	N	N	N
PRESIDENT KENNEDY	139	84.1	Y	Y	Y
PRESIDENT POLK	178	86.5	Y	Y	Y
PRESIDENT TRUMAN	123	32.5	Y	Y	Y
PRESQUE ISLE	329	82.9	L	N	N
PRIDE OF BALTIMORE II	98	42.8	L	L	N
PRINCE OF OCEAN	11	100.0	N	N	N
PRINCE OF TOKYO 2	278	50.3	Y	Y	Y
PRINCE WILLIAM SOUND	69	60.8	Y	N	N
PRINCESS OF SCANDINAVI	227	100.0	N	N	N
PROJECT ORIENT	23	100.0	N	N	N
PUERTO CORTES	35	100.0	N	N	N
PYTCHLEY	210	100.0	N	N	N
QUEEN ELIZABETH 2	94	100.0	N	N	N
QUEEN OF SCANDINAVIA	328	100.0	N	N	N
QUEENSLAND STAR	315	100.0	N	N	N
R. HAL DEAN	65	66.1	L	N	N
R.J. PFEIFFER	100	51.0	Y	Y	Y
RANI PADMINI	57	100.0	N	N	N
RAYMOND E. GALVIN	22	95.4	Y	N	N
REGAL EMPRESS	5	0.0	L	L	L
REGAL PRINCESS	45	100.0	N	N	N
REPULSE BAY	101	100.0	N	N	N
RESERVE	45	66.6	Y	Y	N
RESOLUTE	199	17.5	L	L	N
RHINE FOREST	151	54.9	Y	Y	Y
RICHARD G MATTHIESEN	93	75.2	Y	N	N
RICHARD REISS	45	88.8	L	N	N
RICHMOND BAY	43	100.0	N	N	N
ROBERT E. LEE	16	100.0	N	N	N
ROGER BLOUGH	259	89.9	L	N	N
ROGER REVELLE	81	86.4	Y	Y	Y
ROSINA TOPIC	211	10.9	L	L	L
ROSITA	77	77.9	Y	Y	Y
ROVER	86	100.0	N	N	N
ROYAL MAJESTY	113	35.3	Y	Y	Y
ROYAL PRINCESS	33	100.0	N	N	N
RUBIN BONANZA	58	94.8	Y	N	N
RUBIN KOBE	173	100.0	N	N	N
RUBIN PEARL	94	24.4	L	L	N
RUBIN STAR	54	77.7	L	N	N
RUBIN STELLA	83	73.4	Y	N	N
S.T. CRAPO	100	93.0	L	N	N

NAME	TOTAL OBS	PERCENT VIA RADIO	MANUSCRIPT RECEIVED JUL	AUG	SEP
SAGA CREST	4	100.0	N	N	N
SALINAS	32	100.0	N	N	N
SALOME	143	56.6	Y	Y	Y
SAM HOUSTON	77	54.5	Y	Y	Y
SAMSON	28	100.0	N	N	N
SAMUEL GINN	90	63.3	L	N	N
SAMUEL H. ARMACOST	10	100.0	N	N	N
SAMUEL RISLEY	392	100.0	N	N	N
SAN ISIDRO	55	100.0	N	N	N
SAN MARCOS	87	25.2	L	L	N
SAN VINCENTE	90	100.0	N	N	N
SANKO MOON	37	100.0	N	N	N
SANKO POPPY	37	100.0	N	N	N
SANKO SPRUCE	43	53.4	L	N	N
SANTORIN 2	187	100.0	N	N	N
SARAJEVO EXPRESS	2	100.0	N	N	N
SARAMATI	156	75.0	Y	Y	Y
SAUDI ABHA	67	100.0	N	N	N
SAUDI QASSIM	36	0.0	L	L	N
SAVANNAH	7	100.0	N	N	N
SCHACKENBORG	16	100.0	N	N	N
SEA COMMERCE	131	64.1	Y	Y	Y
SEA FLORIDA	194	76.2	Y	Y	Y
SEA FOX	205	55.6	Y	Y	Y
SEA HARMONY	49	100.0	N	N	N
SEA INITIATIVE	85	100.0	N	N	N
SEA ISLE CITY	8	25.0	Y	N	N
SEA JUSTICE	155	96.1	Y	Y	Y
SEA LION	349	33.5	Y	Y	Y
SEA MARINER	172	80.8	Y	Y	Y
SEA MERCHANT	344	95.3	Y	Y	Y
SEA NOVIA	62	77.4	Y	Y	Y
SEA PRINCESS	72	72.2	Y	Y	Y
SEA RACER	143	48.9	Y	Y	N
SEA SPRAY	14	100.0	N	N	N
SEA TRADE	192	82.2	L	N	N
SEA WOLF	295	74.9	Y	Y	Y
SEA/LAND VICTORY	95	100.0	N	N	N
SEABOARD OCEAN	59	42.3	Y	N	N
SEABOARD SUN	39	0.0	Y	Y	Y
SEABOARD UNIVERSE	100	98.0	Y	Y	Y
SEABREEZE I	64	56.2	L	N	N
SEACHAMPION	150	92.0	Y	Y	Y
SEALAND ANCHORAGE	162	37.6	Y	Y	Y
SEALAND ATLANTIC	218	88.9	Y	Y	Y
SEALAND CHALLENGER	102	51.9	Y	Y	Y
SEALAND CHAMPION	103	92.2	L	N	N
SEALAND COMET	124	85.4	Y	Y	Y
SEALAND CONSUMER	159	91.8	Y	Y	N
SEALAND CRUSADER	341	82.1	Y	Y	Y
SEALAND DEFENDER	98	42.8	Y	Y	Y
SEALAND DEVELOPER	108	46.2	Y	Y	Y
SEALAND DISCOVERY	190	30.0	Y	Y	Y
SEALAND ENDURANCE	122	31.9	Y	Y	Y
SEALAND ENTERPRISE	405	88.6	Y	Y	Y
SEALAND EXPEDITION	40	2.5	Y	N	N
SEALAND EXPLORER	142	81.6	Y	Y	Y
SEALAND EXPRESS	150	73.3	Y	N	N
SEALAND FREEDOM	99	0.0	L	L	L
SEALAND HAWAII	138	92.7	Y	Y	Y
SEALAND INDEPENDENCE	116	44.8	Y	Y	Y
SEALAND INNOVATOR	117	85.4	Y	Y	Y
SEALAND INTEGRITY	393	99.4	Y	N	N
SEALAND KODIAK	40	12.5	Y	Y	Y
SEALAND LIBERATOR	72	100.0	N	N	N
SEALAND MARINER	115	100.0	N	N	N

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NAME	TOTAL OBS	PERCENT VIA RADIO	MANUSCRIPT RECEIVED JUL	AUG	SEP
SEALAND MERCURY	102	100.0	N	N	N
SEALAND METEOR	143	77.6	Y	Y	Y
SEALAND NAVIGATOR	279	70.2	Y	Y	Y
SEALAND PACER	25	100.0	N	N	N
SEALAND PACIFIC	295	91.5	Y	Y	Y
SEALAND PATRIOT	40	100.0	N	N	N
SEALAND PERFORMANCE	229	96.0	Y	N	N
SEALAND PRODUCER	131	92.3	L	N	N
SEALAND QUALITY	35	100.0	N	N	N
SEALAND RACER	30	100.0	N	N	N
SEALAND RELIANCE	130	59.2	Y	Y	Y
SEALAND SPIRIT	140	47.8	Y	Y	Y
SEALAND TACOMA	84	46.4	Y	Y	Y
SEALAND TRADER	330	87.2	Y	Y	Y
SEALAND VOYAGER	129	85.2	Y	Y	Y
SEARIVER BATON ROUGE	5	80.0	L	N	N
SEARIVER BENICIA	16	75.0	L	N	N
SEARIVER LONG BEACH	17	82.3	Y	N	N
SEARIVER WILMINGTON	4	100.0	N	N	N
SEDCO/BP 471	413	88.1	Y	Y	Y
SEIJIN	43	100.0	N	N	N
SENATOR	34	100.0	N	N	N
SENORITA	107	68.2	L	N	N
SENSATION	85	92.9	L	N	N
SERENITY	120	43.3	Y	Y	N
SETO BRIDGE	149	100.0	N	N	N
SEVEN OCEAN	55	98.1	Y	N	N
SEWARD JOHNSON	173	72.2	L	N	N
SGT WILLIAM A BUTTON	52	59.6	Y	N	N
SGT. METEJ KOCAK	36	100.0	N	N	N
SHELLY BAY	50	98.0	L	N	N
SHIN OJI	75	100.0	N	N	N
SHIRAOI MARU	223	87.4	Y	Y	Y
SIBOHELLE	35	100.0	N	N	N
SIDNEY STAR	115	100.0	N	N	N
SIERRA MADRE	7	100.0	N	N	N
SIGAL	5	100.0	N	N	N
SINCERE GEMINI	74	97.2	L	N	N
SINCERE SUCCESS	29	100.0	N	N	N
SKAUBRYN	222	100.0	N	N	N
SKAUGRAN	125	100.0	N	N	N
SKOGAFOSS	51	100.0	N	N	N
SOKOLICA	74	97.2	L	N	N
SOL DO BRASIL	65	100.0	N	N	N
SOLAR WING	100	100.0	N	N	N
SONG OF AMERICA	63	100.0	N	N	N
SONORA	168	100.0	N	N	N
SOREN TOUBRO	14	100.0	N	N	N
SOUTH FORTUNE	32	100.0	N	N	N
SOUTHERN LION	1	100.0	N	N	N
SOUTHERN PRINCESS	47	0.0	Y	N	N
SOVEREIGN OF THE SEAS	78	92.3	Y	N	N
SP5. ERIC G. GIBSON	81	96.2	Y	N	N
SPAR EIGHT	157	37.5	Y	Y	Y
SPRING BEAR	177	100.0	N	N	N
SPRING GANNET	202	45.5	Y	Y	Y
SPRING WAVE	36	30.5	L	L	N
ST BLAIZE	75	100.0	N	N	N
STAR ALABAMA	2	100.0	N	N	N
STAR AMERICA	133	48.1	Y	N	N
STAR EAGLE	23	100.0	N	N	N
STAR EVVIVA	67	91.0	Y	N	N
STAR FLORIDA	33	100.0	N	N	N
STAR FRASER	101	100.0	N	N	N
STAR FUJI	39	100.0	N	N	N
STAR GRAN	125	100.0	N	N	N
STAR HANSA	225	15.5	Y	Y	Y
STAR HERDLA	85	89.4	Y	N	N
STAR SKARVEN	67	37.3	Y	Y	Y
STATE OF GUIARAT	2	100.0	N	N	N
STELLA	32	100.0	N	N	N
STELLA LYKES	168	47.6	L	L	N
STEPAN KRASHENINNIKOV	21	100.0	N	N	N
STEPHAN J	352	96.3	Y	Y	Y
STEWART J. CORT	328	89.0	L	N	N
STOLT CONDOR	20	100.0	N	N	N
STOLT TENACITY	74	100.0	N	N	N
STOLT VINLAND	62	100.0	N	N	N
STONEWALL JACKSON	17	100.0	N	N	N
STRONG CAJUN	109	73.3	Y	Y	Y
STRONG ICELANDER	76	100.0	N	N	N
STRONG VIRGINIAN	184	73.3	Y	Y	Y
SUN DANCE	19	57.8	L	N	N
SUN PRINCESS	8	100.0	N	N	N
SUNBELT DIXIE	44	100.0	N	N	N
SUNDA	235	100.0	N	N	N
SUPER RUBIN	160	94.3	Y	Y	Y
SVEN OLTMANN	107	100.0	N	N	N
SWAN ARROW	12	100.0	N	N	N
TADEUSZ OCIOSZYNSKI	11	100.0	N	N	N
TAI HE	202	100.0	N	N	N
TAI SHAN HAI	2	100.0	N	N	N
TAI SHING	83	68.6	Y	Y	Y
TAKARA	40	75.0	Y	N	N
TALLAHASSEE BAY	50	100.0	N	N	N
TAMPA BAY	46	100.0	N	N	N
TARAGO	175	100.0	N	N	N
TELLUS	167	71.2	Y	Y	Y
TEPOZTECO II	84	100.0	N	N	N
TEQUI	148	85.1	Y	Y	Y
TEUTONIA	97	91.7	L	N	N
TEXAS CLIPPER	29	100.0	N	N	N
THOMAS G. THOMPSON	45	84.4	L	N	N
THOMPSON LYKES	81	44.4	L	L	N
THORKIL MAERSK	63	100.0	N	N	N
TILLIE LYKES	163	92.0	Y	Y	Y
TJALDRID	16	100.0	N	N	N
TMM MEXICO	88	98.8	Y	N	N
TMM VERACRUZ	94	100.0	N	N	N
TOKIO EXPRESS	203	100.0	N	N	N
TOLUCA	134	100.0	N	N	N
TONSINA	89	100.0	N	N	N
TORBEN	253	41.5	Y	Y	Y
TORM FREYA	73	53.4	N	N	N
TOWER BRIDGE	41	100.0	L	N	N
TRANSWORLD BRIDGE	108	98.1	L	N	N
TRIGGER	34	73.5	Y	Y	Y
TRITON	263	73.3	L	N	N
TROPIC DAY	35	2.8	L	L	L
TROPIC FLYER	62	0.0	L	L	L
TROPIC JADE	109	23.8	Y	Y	Y
TROPIC KEY	28	17.8	Y	N	N
TROPIC LURE	22	0.0	Y	N	N
TROPIC MIST	11	0.0	Y	N	N
TROPIC SUN	187	95.1	Y	Y	Y
TROPIC TIDE	95	92.6	Y	Y	Y
TROPICALE	15	100.0	N	N	N
TRSL ARCTURUS	69	98.5	L	N	N
TRSL CONCORD	15	100.0	N	N	N
TRUST 38	153	9.8	L	L	L
TSL GALLANT	9	100.0	N	N	N
TULSIDAS	28	100.0	N	N	N

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NAME	TOTAL OBS	PERCENT VIA RADIO	MANUSCRIPT RECEIVED JUL	AUG	SEP
TURMOIL	157	100.0	N	N	N
TYSON LYKES	107	37.3	Y	Y	Y
ULLSWATER	134	100.0	N	N	N
USCGC ACACIA (WLB406)	55	47.2	L	L	N
USCGC ACTIVE WMEC 618	114	42.9	L	L	N
USCGC ACUSHNET WMEC 16	177	92.6	Y	Y	Y
USCGC ALERT (WMEC 630)	150	100.0	N	N	N
USCGC BASSWOOD (WLB 38	93	100.0	N	N	N
USCGC BEAR (WEMC 901)	57	89.4	L	N	N
USCGC BOUTWELL WHEC 71	58	100.0	N	N	N
USCGC CAMPBELL	4	100.0	N	N	N
USCGC CHASE (WHEC 718)	80	81.2	L	N	N
USCGC CONFIDENCE WMEC6	67	82.0	L	N	N
USCGC COURAGEOUS	51	47.0	Y	Y	Y
USCGC DAUNTLESS WMEC 6	45	100.0	N	N	N
USCGC DILIGENCE WMEC 6	129	16.2	L	L	N
USCGC DURABLE (WMEC 62	33	100.0	N	N	N
USCGC EAGLE (WIX 327)	7	100.0	N	N	N
USCGC FIREBUSH WLB 393	27	100.0	N	N	N
USCGC FORWARD	85	100.0	N	N	N
USCGC GALLATIN WMEC 72	69	65.2	L	N	N
USCGC HAMILTON WHEC 71	327	0.3	L	L	L
USCGC HARRIET LANE	86	100.0	N	N	N
USCGC IRONWOOD (WLB 29	9	100.0	N	N	N
USCGC JARVIS (WHEC 725	10	100.0	N	N	N
USCGC LEGARE	6	100.0	N	N	N
USCGC MACKINAW	5	100.0	N	N	N
USCGC MALLOW (WLB 396)	86	100.0	N	N	N
USCGC MELLON (WHEC 717	40	100.0	N	N	N
USCGC MIDGETT (WHEC 72	61	91.8	Y	Y	N
USCGC MOHAWK WMEC 913	10	100.0	N	N	N
USCGC MORGENTHAU	33	100.0	N	N	N
USCGC MUNRO	190	85.2	L	N	N
USCGC NORTHLAND WMEC 9	62	80.6	L	N	N
USCGC POLAR SEA__(WAGB	203	100.0	N	N	N
USCGC RELIANCE WMEC 61	72	100.0	N	N	N
USCGC SEDGE (WLB 402)	3	100.0	N	N	N
USCGC SENECA	85	100.0	N	N	N
USCGC SHERMAN	81	80.2	L	N	N
USCGC SPENCER	2	100.0	N	N	N
USCGC STEADFAST (WMEC	181	25.9	L	L	N
USCGC STORIS (WMEC 38)	89	100.0	N	N	N
USCGC SUNDEW (WLB 404)	30	40.0	L	L	N
USCGC SWEETBRIER WLB 4	20	95.0	L	N	N
USCGC TAHOMA	165	90.3	Y	Y	Y
USCGC THETIS	4	75.0	L	N	N
USCGC VALIANT (WMEC 62	18	66.6	Y	N	N
USCGC VENTUROUS WMEC 6	27	100.0	N	N	N
USCGC VIGILANT WMEC 61	7	100.0	N	N	N
USCGC VIGOROUS WMEC 62	73	78.0	L	N	N
USCGC WOODRUSH (WLB 40	37	100.0	N	N	N
USNS ALGOL	8	0.0	L	N	N
USNS ALTAIR	12	50.0	Y	N	N
USNS ANTARES	9	0.0	L	N	N
USNS APACHE (T-ATF 172	5	100.0	N	N	N
USNS BIGHORN	33	0.0	Y	N	N
USNS BOWDITCH	26	100.0	N	N	N
USNS DENEBOLA	2	0.0	Y	N	N
USNS GUS W. DARNELL	55	100.0	N	N	N
USNS HAYES	162	0.0	Y	Y	Y
USNS HENRY J. KAISER	7	100.0	N	N	N
USNS JOHN MCDONNELL (T	30	100.0	N	N	N
USNS KANAWHA T-AO 196	24	0.0	L	N	N
USNS KANE TAGS 27	151	12.5	L	L	L
USNS LARAMIE T-AO 203	7	100.0	N	N	N
USNS MOHAWK (T-ATF 170	72	100.0	N	N	N
USNS NARRAGANSETT	61	100.0	N	N	N
USNS NAVAJO_(TATF-169)	39	94.8	Y	N	N
USNS PATHFINDER T-AGS	268	34.3	Y	N	N
USNS PATUXENT	184	100.0	N	N	N
USNS PECOS	76	100.0	N	N	N
USNS POWHATAN TATF 166	70	95.7	L	N	N
USNS RAPPAHANNOCK TAO-	17	100.0	N	N	N
USNS SAN DIEGO	39	100.0	N	N	N
USNS SATURN T-AFS-10	120	0.0	L	L	L
USNS SILAS BENT T-AGS	131	73.2	Y	Y	Y
USNS SPICA (T-AFS 9)	31	100.0	N	N	N
USNS SUMNER	1	100.0	N	N	N
USNS VANGUARD TAG 194	72	11.1	Y	N	N
USNS WALTER S. DIEHL	32	0.0	Y	N	N
USNS WYMAN (T-AGS 34)	52	100.0	N	N	N
USNS YUKON (T-AO 202)	64	82.8	L	N	N
USS RUSSELL DDG-59	179	100.0	N	N	N
VASILTY BURKHANOV	106	100.0	N	N	N
VEGA	166	100.0	N	N	N
VENUS DIAMOND	51	100.0	N	N	N
VINE	180	100.0	N	N	N
VIRGINIA	186	20.4	Y	Y	Y
VISAYAN GLORY	128	64.0	Y	Y	Y
VIVA	34	44.1	Y	N	N
WALTER J. MCCARTHY	130	83.8	L	N	N
WESTERBROOK	135	61.4	Y	Y	Y
WESTERN FRIEND	260	23.0	Y	Y	Y
WESTERN LION	5	100.0	N	N	N
WESTWARD	21	61.9	L	N	N
WESTWARD VENTURE	483	81.7	Y	Y	Y
WESTWOOD ANETTE	134	76.1	Y	Y	Y
WESTWOOD BELINDA	236	89.4	Y	N	N
WESTWOOD CLEO	128	96.8	Y	Y	Y
WESTWOOD FUJI	254	90.9	Y	Y	Y
WESTWOOD HALLA	80	85.0	Y	Y	Y
WESTWOOD JAGO	84	100.0	N	N	N
WESTWOOD MARIANNE	120	83.3	Y	Y	Y
WILFRED SYKES	40	70.0	L	N	N
WILLIAM E. CRAIN	134	0.0	Y	N	N
WILLIAM E. MUSSMAN	132	25.0	Y	Y	Y
WILSON	76	50.0	Y	Y	N
WOLVERINE	84	91.6	L	N	N
YOHFU	61	16.3	L	L	L
YUCATAN	26	100.0	N	N	N
YURIY OSTROVSKIY	158	87.3	Y	Y	Y
YUYO BREEZE	30	16.6	Y	N	N
ZAGREB EXPRESS	19	100.0	N	N	N
ZENITH	66	100.0	N	N	N
ZETLAND	156	100.0	N	N	N
ZIM AMERICA	89	100.0	N	N	N
ZIM ASIA	96	100.0	N	N	N
ZIM CANADA	169	100.0	N	N	N
ZIM HONGKONG	1	100.0	N	N	N
ZIM IBERIA	41	100.0	N	N	N
ZIM ISRAEL	104	100.0	N	N	N
ZIM ITALIA	84	100.0	N	N	N
ZIM JAPAN	101	100.0	N	N	N
ZIM KEELUNG	56	100.0	N	N	N
ZIM KOREA	24	100.0	N	N	N
ZIM MONTEVIDEO	39	92.3	Y	N	N

GRAND TOTAL	114,956
TOTAL VIA RADIO	90,173
PERCENT VIA RADIO	78.4

Buoy Climatological Data Summary — 2nd and 3rd Quarters 1996

Weather observations are taken each hour during a 20-minute averaging period, with a sample taken every 0.67 seconds. The significant wave height is defined as the average height of the highest one-third of the waves during the average period each hour. The maximum significant wave height is the highest of those values for that month. At most stations, air temperature, water temperature, wind speed and direction are sampled once per second during an 8.0-minute averaging period each hour (moored buoys) and a 2.0-minute averaging period for fixed stations (C-MAN). Contact NDBC Data Systems Division, Bldg. 1100, Stennis Space Center, MS 39529, or phone (601) 688-1720 for more details.

BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	MAX SIG WAVE HT (DA/HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA/HR)	MEAN PRESS (MB)
SEPTEMBER 1996													
41001	34.7N	072.6W	0718	24.8	26.3	2.0	7.9	01/06	12.9	S	32.8	01/02	1014.8
41002	32.3N	075.2W	0114	25.3	26.0	1.4	2.2	28/12	10.3	S	19.2	28/10	1021.1
41004	32.5N	079.1W	0115	25.8	26.9	2.6	7.8	05/18	13.6	NE	47.4	05/18	1012.1
41009	28.5N	080.2W	1432	27.3	28.2	1.1	4.4	05/04	9.6	SE	22.3	11/21	1013.8
41010	28.9N	078.5W	1431	27.1	28.0	1.7	7.2	04/23	10.9	SE	33.4	05/05	1013.1
41021	31.9N	080.9W	0709	25.7	27.1	0.6	1.4	27/08	11.3	S	22.9	05/15	1014.3
41022	31.9N	080.9W	0719	25.8	27.2	0.6	1.4	17/01					1013.9
41023	31.9N	080.9W	0273	26.2	27.8	0.3	0.9	01/01	10.2	S	22.2	05/17	1012.3
42001	25.9N	089.7W	0709	28.8	30.1	0.5	1.8	30/00	7.6	S	20.2	16/11	1013.6
42002	25.9N	093.6W	0717	28.6	29.6	0.7	2.4	29/01	9.4	S	24.9	28/11	1012.4
42003	25.9N	085.9W	0710	28.5	29.9	0.2	0.6	01/17	7.5	SE	17.9	27/07	1013.1
42007	30.1N	088.8W	0718	26.7	28.7				10.6	NE	25.1	29/11	1013.0
42019	27.9N	095.0W	0715	27.6		0.8	3.0	28/07	8.8	S	25.8	28/09	1012.5
42020	27.0N	096.5W	0719	27.9		0.8	3.0	28/07	10.9	SE	27.2	07/15	1012.0
42035	29.3N	094.4W	0716	27.3	29.0	0.7	2.4	16/00	9.5	S	26.6	28/02	1012.5
42036	28.5N	084.5W	0713	27.9	29.1	0.5	2.2	27/11	8.3	NW	23.3	21/21	1013.1
42039	28.8N	086.0W	0718	28.9		0.6	2.4	26/19	8.5	NW	27.6	21/19	1014.1
42040	29.2N	088.3W	0717	27.2	28.7	0.6	2.0	16/14	8.8	SW	23.7	21/16	1014.0
44004	38.5N	070.7W	0718	20.9	21.0	1.9	11.0	01/16	11.3	S	45.7	01/16	1014.2
44007	43.5N	070.2W	0717	14.5	13.9	0.9	3.1	02/18	9.4	N	26.4	18/14	1013.4
44008	40.5N	069.4W	0710	15.4	14.3	1.7	9.3	02/03	9.4	SW	38.7	02/05	1013.4
44009	38.5N	074.7W	0718	21.3	22.2	1.2	4.0	01/15	12.2	S	24.7	17/08	1013.7
44011	41.1N	066.6W	0714	15.1	13.5	1.9	9.3	02/16	11.0	SW	45.3	14/16	1012.2
44013	42.4N	070.7W	0718	16.4	16.3	1.0	4.4	02/16	10.4	N	34.4	18/10	1013.7
44014	36.6N	074.8W	0713	22.5	22.3	1.5	6.1	01/21	11.0	S	29.9	17/07	1014.5
44025	40.3N	073.2W	0705	19.4	19.4	1.2	4.6	01/22	11.3	S	29.7	17/10	1013.8
44028	41.4N	071.1W	0711	17.3	18.0	0.8	2.9	02/01	12.4	SW	39.6	02/13	1013.7
45001	48.1N	087.8W	0716	10.9	9.8	0.6	2.8	12/06	9.7	SE	28.4	12/02	1014.7
45002	45.3N	086.4W	0717	16.2	17.6	0.8	2.8	28/13	12.4	N	31.3	12/22	1012.8
45003	45.3N	082.8W	0718	15.7	15.5	0.8	2.9	27/10	10.0	NE	30.1	14/09	1013.3
45004	47.6N	086.5W	0715	10.4	9.1	0.7	2.5	27/08	8.9	N	26.0	27/05	1015.1
45005	41.7N	082.4W	0717	19.2	20.8				12.9	SW	30.3	11/23	1012.7
45006	47.3N	089.9W	0716	13.6	13.2	0.7	2.7	12/08	9.5	NE	28.0	26/17	1014.0
45007	42.7N	087.0W	0707	17.9	19.6	0.9	3.8	13/04	11.2	NW	29.9	26/17	1013.4
45008	44.3N	082.4W	0715	16.8	17.4	0.8	2.6	14/09	9.9	NE	30.3	14/18	1013.4
46001	56.3N	148.2W	0713	10.5	12.2	2.3	7.3	18/08	14.3	W	33.6	18/10	1008.3
46002	42.5N	130.3W	0717	16.7	17.8	2.1	4.6	16/01	13.1	N	25.5	04/11	1017.8
46003	51.9N	155.9W	0719	10.3	10.9	2.6	6.3	17/07	14.2	W	38.3	17/06	1012.8
46005	46.1N	131.0W	0718	15.4	16.7	2.0	5.3	16/00	12.1	NW	25.1	15/21	1018.6
46006	40.9N	137.5W	0716	18.2	19.0	2.1	5.2	23/14					1019.9

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BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	MAX SIG WAVE HT (DA/HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA/HR)	MEAN PRESS (MB)
46011	34.9N	120.9W	0716	14.2	15.7	1.6	3.3	17/05	8.3	NW	21.4	16/22	1012.3
46012	37.4N	122.7W	0715	13.3	13.6	1.6	3.1	17/06	7.6	NW	21.8	16/11	1012.4
46013	38.2N	123.3W	0658	12.3	12.2	1.7	3.5	17/01	10.3	NW	27.8	18/01	1014.1
46014	39.2N	124.0W	0719	12.8	12.7	1.9	4.3	17/02	9.8	NW	27.0	22/01	1013.2
46025	33.8N	119.1W	0714	18.0	20.3	0.8	1.5	13/03	6.1	W	17.7	13/02	1011.3
46026	37.8N	122.8W	0717	12.9	13.8	1.5	2.8	17/05	8.4	NW	25.6	16/04	1012.7
46027	41.9N	124.4W	0714	12.0	11.6	1.7	3.3	01/22	8.8	NW	31.9	01/00	1013.8
46028	35.7N	121.9W	0712	14.0	14.8	1.8	3.5	17/03	10.9	NW	26.8	05/02	1013.9
46029	46.3N	124.3W	0277	14.5	14.8	1.2	2.2	10/02	8.4	S	18.7	07/06	1015.4
46030	40.4N	124.5W	0714	11.9	11.2	1.9	3.6	01/05	9.9	N	23.7	15/06	1015.0
46035	56.9N	177.8W	0020	7.4	8.9	1.1	1.3	30/19	4.9	SW	13.2	30/04	1041.8
46041	47.4N	124.5W	0716	14.7		1.5	3.6	19/19	8.0	NW	23.5	13/12	1015.7
46042	36.8N	122.4W	0709	16.1	13.6	1.7	3.2	17/06	5.4	NW	19.2	01/00	1013.4
46045	33.8N	118.5W	0716	18.7	20.0	0.7	1.4	13/04	5.6	NW	15.2	13/03	1011.1
46051	34.5N	120.7W	0718	16.0		1.7	3.3	17/05	11.8	NW	22.3	15/03	1012.2
46053	34.2N	119.9W	0708	16.9	18.6	1.0	2.3	17/00	9.2	W	26.0	14/00	1011.3
46054	34.3N	120.5W	0716	15.3	16.6	1.6	3.1	17/11	15.4	NW	29.3	11/23	1012.0
46059	38.0N	130.0W	0713	18.4	18.7	2.0	3.7	16/19					1018.9
46060	60.6N	146.8W	1430	10.3	12.3	0.6	3.6	17/20	10.9	E	41.8	25/11	1008.4
46061	60.2N	146.8W	1435	12.2		1.4	7.6	17/19	12.8	E	50.5	17/17	1008.3
51001	23.4N	162.3W	0717	27.3	28.3	2.0	3.8	26/10	11.5	E	23.7	08/11	1015.5
51002	17.2N	157.8W	0717	27.0	27.9	2.0	3.7	19/12	14.5	E	23.7	19/10	1011.8
51003	19.1N	160.8W	0715	27.2	28.4	1.8	3.0	27/04	9.7	NE	22.1	03/10	1012.9
51004	17.4N	152.5W	0719	26.2		2.0	3.5	18/07	13.2	E	22.8	18/17	1013.5
51026	21.4N	156.9W	0708	26.1	26.9	1.7	2.7	18/18					1015.0
91204	9.9N	139.7E	0484	28.7					4.9	SW	25.2	02/06	1007.7
91222	18.1N	145.8E	0711	27.8									1007.2
91251	11.4N	162.4E	0707	28.6					8.3	E	27.7	07/10	1008.1
91328	8.6N	149.7E	0718	28.2					5.4	S	19.6	09/15	1009.7
91343	7.6N	155.2E	0715	28.3									1007.6
91352	6.2N	160.7E	0716	28.1					4.0	E	14.1	27/07	1009.0
91355	5.4N	163.0E	0718	27.3					5.1	E	18.4	19/17	1007.6
91374	8.7N	171.2E	0717	27.6					3.9	E	16.6	10/22	1009.4
91377	6.1N	172.1E	0462	28.2					7.1	E	19.4	14/19	1011.3
91411	8.3N	137.5E	0686	27.8									1007.7
91442	4.6N	168.7E	0702	28.5					9.0	E	27.3	28/00	1008.6
ABAN6	44.3N	075.9W	0713	16.8	19.5				4.2	S	22.5	23/02	1014.4
ALSN6	40.5N	073.8W	0714	20.0	0.8		3.1	02/05	14.2	W	44.3	17/12	1014.1
BLIA2	60.8N	146.9W	1431	9.2					9.5	N	42.9	25/13	1009.1
BURL1	28.9N	089.4W	0718	27.5					9.2	SW	28.7	16/09	1014.7
BUSL1	27.9N	090.9W	0687	28.5					8.0	SW	28.0	21/17	1013.2
CARO3	43.3N	124.4W	0716	14.2					8.2	N	28.6	23/01	1015.7
CDRF1	29.1N	083.0W	0715	26.7					7.3	W	22.6	16/12	1014.0
CHLV2	36.9N	075.7W	0716	22.8	23.8	1.1	3.0	06/13	14.7	S	39.6	06/10	1014.7
CLKN7	34.6N	076.5W	0714	24.6					12.5	SW	56.4	06/03	1014.5
CSBF1	29.7N	085.4W	0716	26.6					7.0	NE	23.9	26/17	1013.8
DBLN6	42.5N	079.4W	0714	17.5					9.5	SE	36.4	22/21	1013.4
DESW1	47.7N	124.5W	0716	18.4					7.8	NW	26.6	14/02	1016.0
DISW3	47.1N	090.7W	0715	15.1					10.3	E	29.3	26/22	1015.1
DPIA1	30.3N	088.1W	0713	26.4	28.7				9.5	N	25.9	29/12	1013.7
DRYF1	24.6N	082.9W	0715	28.6					7.2	E	21.5	27/06	1013.5
DSLN7	35.2N	075.3W	0712	24.0	1.6		6.7	06/03	16.9	SW	57.8	06/04	1014.3
DUCN7	36.2N	075.8W	0714	23.2	0.9		3.3	01/18	12.2	SW	40.7	06/09	1015.5
FBIS1	32.7N	079.9W	0719	25.3					8.8	SW	24.1	05/17	1014.2
FFIA2	57.3N	133.6W	0717	9.6					9.3	SE	33.0	17/21	1012.9
FWYF1	25.6N	080.1W	0716	29.3					10.5	E	26.6	16/13	1014.2
GDIL1	29.3N	090.0W	0717	27.1	29.2				8.0	SW	28.5	21/12	1013.4
IOSN3	43.0N	070.6W	0715	15.6					12.7	NE	39.2	18/12	1013.8
KTNF1	29.8N	083.6W	0715	25.1					6.8	NE	23.5	17/20	1013.6
LKWF1	26.6N	080.0W	0715	27.5	29.0				9.1	E	23.2	04/19	1013.6
LONF1	24.9N	080.9W	0716	28.6	30.4				8.4	E	27.8	30/19	1014.1
MDRM1	44.0N	068.1W	0715	13.0					14.5	NE	40.5	02/20	1013.7
MISM1	43.8N	068.9W	0716	13.1					14.1	NE	35.8	13/21	1013.8
MLRF1	25.0N	080.4W	0716	28.4	29.5				8.8	E	22.7	12/23	1013.9
NWPO3	44.6N	124.1W	0718	12.5					8.1	N	27.4	02/04	1015.6
POTA2	61.1N	146.7W	1431	8.0					11.6	N	29.9	26/02	1009.0
PTAC1	39.0N	123.7W	0716	12.1					9.1	N	22.5	18/07	1013.9
PTAT2	27.8N	097.1W	0717	27.2	29.3				12.0	SE	30.0	28/05	1012.5
ROAM4	47.9N	089.3W	0710	13.4					12.0	NE	37.0	27/06	1014.7
SANF1	24.5N	081.9W	0716	28.6	29.8				8.6	E	22.7	08/05	1013.2
SAUF1	29.9N	081.3W	0715	25.8	27.8				8.6	SE	22.3	27/13	1014.4
SBIO1	41.6N	082.8W	0713	19.0					11.8	NW	34.9	07/19	1013.9
SGNW3	43.8N	087.7W	0716	16.3					10.5	NW	33.3	26/22	1015.1
SISW1	48.3N	122.9W	0625	12.1					6.9	SW	26.1	13/16	1016.3
SMKF1	24.6N	081.1W	0718	28.6	30.0				9.1	E	24.4	30/06	1013.9
SPGF1	26.7N	079.0W	0717	27.7					6.3	SE	22.2	04/20	1014.1
SRST2	29.7N	094.1W	0716	26.0					9.2	S	33.0	21/06	1013.1
STDM4	47.2N	087.2W	0716	13.0					14.5	N	39.1	29/15	1014.6
SUPN6	44.5N	075.8W	0717	17.0	20.1				7.9	S	24.1	28/14	1015.1
SVLS1	32.0N	080.7W	0716	26.0	27.3	0.7	1.9	01/00	12.7	S	29.9	05/19	1014.0
THIN6	44.3N	076.0W	0718	16.7									

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BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	MAX SIG WAVE HT (DA/HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA/HR)	MEAN PRESS (MB)
TPLM2	38.9N	076.4W	0713	21.4	23.5				10.9	NW	31.9	06/20	1014.2
TTIW1	48.4N	124.7W	0715	12.4					9.1	S	32.1	23/15	1016.2
VENF1	27.1N	082.5W	0718	26.8	30.0				7.4	E	21.5	04/23	1014.3
WPOW1	47.7N	122.4W	0651	13.2					8.1	N	24.7	15/22	1016.5
AUGUST 1996													
41001	34.7N	072.6W	0738	25.7	27.1	1.3	6.5	31/23	9.5	S	31.1	31/23	1018.4
41002	32.4N	075.3W	0741	26.5	27.7	1.3	5.2	31/06	8.6	SW	24.5	14/14	1017.8
41004	32.5N	079.1W	0736	26.7	27.8	0.9	3.8	31/02	8.3	NE	20.2	12/20	1018.6
41009	28.5N	080.2W	1484	27.2	28.2	0.7	2.8	30/10	8.2	E	23.9	12/19	1017.8
41010	28.9N	078.5W	1481	27.5	28.6	1.1	4.0	31/01	8.0	S	23.7	03/07	1017.3
41021	31.9N	080.9W	0739	26.8	28.6	0.5	1.5	30/23	9.7	S	21.4	21/15	1018.3
41022	31.9N	080.9W	0743	26.8	28.7	0.6	1.6	30/23	10.5	SW	21.2	01/02	1018.0
41023	31.9N	080.9W	0742	26.5	28.6	0.3	1.1	31/01	8.9	E	22.0	01/02	1018.2
42001	25.9N	089.7W	0741	28.5	29.7	0.7	2.8	21/03	8.7	E	28.4	20/22	1016.6
42002	25.9N	093.6W	0736	28.9	29.8	0.9	3.1	23/08	10.1	SE	22.0	14/17	1015.8
42003	25.9N	085.9W	0733	28.5	29.8	0.7	2.7	21/18	8.4	E	24.5	20/01	1016.6
42007	30.1N	088.8W	0743	27.7	29.6				9.2	E	26.4	21/18	1016.9
42019	27.9N	095.0W	0741	28.3	0.9		2.5	23/04	9.8	SE	28.2	13/12	1015.9
42020	27.0N	096.5W	0700	28.4	1.0		3.2	24/03	11.6	SE	22.2	03/08	1015.3
42035	29.3N	094.4W	0738	28.4	29.7	0.8	2.3	22/05	9.9	SE	23.7	21/14	1016.1
42036	28.5N	084.5W	0740	28.3	29.5	0.6	2.3	21/04	7.5	E	24.3	12/14	1016.8
42039	28.8N	086.0W	0738	29.4	0.6		2.8	21/18	7.8	E	22.5	21/16	1017.9
42040	29.2N	088.3W	0742	28.1	29.5	0.6	3.2	21/22	7.8	E	25.3	21/19	1017.9
44004	38.5N	070.7W	0740	23.5	25.0	1.0	2.9	30/15	8.3	NE	19.4	02/07	1019.1
44005	42.9N	069.0W	0673	17.7	16.0	0.7	1.6	21/06	7.2	SW	19.4	09/01	1018.3
44007	43.5N	070.2W	0739	17.1	16.2	0.6	1.4	09/00	6.4	S	18.7	25/21	1017.7
44008	40.5N	069.4W	0741	17.0	16.8	0.8	2.6	31/19	6.3	N	16.9	13/18	1019.5
44009	38.5N	074.7W	0739	22.6	23.5	0.7	2.6	14/00	7.8	S	23.9	13/22	1018.7
44011	41.1N	066.6W	0736	16.2	15.5	0.9	2.6	31/23	6.6	N	18.7	14/08	1018.3
44013	42.4N	070.7W	0729	18.9	18.3	0.4	0.8	01/00	7.3	SW	15.9	11/06	1018.6
44014	36.6N	074.8W	0738	23.9	24.6	0.9	4.7	31/13	7.8	NE	22.2	31/14	1018.9
44025	40.3N	073.2W	0735	21.5	21.8	0.8	2.5	31/21	8.5	S	24.7	13/15	1019.1
44028	41.4N	071.1W	0733	18.9	18.8	0.5	1.5	01/21	8.5	SW	22.0	24/15	1019.2
45001	48.1N	087.8W	0741	9.0	5.4	0.4	1.8	25/07	9.1	SW	25.6	14/08	1016.6
45002	45.3N	086.4W	0739	19.1	19.1	0.5	2.5	06/00	9.4	S	24.1	06/01	1017.3
45003	45.3N	082.8W	0738	17.7	17.5	0.5	1.5	10/04	9.1	S	21.4	27/05	1018.1
45004	47.6N	086.5W	0741	8.0	4.7	0.4	2.1	25/09	7.9	SE	22.0	05/18	1017.8
45005	41.7N	082.4W	0741	23.0	23.7				7.1	S	20.2	09/07	1018.2
45006	47.3N	089.9W	0740	14.1	11.6	0.4	1.7	25/09	7.8	SW	19.8	25/04	1016.0
45007	42.7N	087.0W	0730	21.1	21.4	0.4	1.4	23/10	7.8	S	20.4	23/10	1017.7
45008	44.3N	082.4W	0742	18.9	18.7	0.5	1.6	25/12	8.0	S	20.6	27/06	1018.7
46001	56.3N	148.2W	0735	12.5	13.0	1.5	3.0	26/15	10.5	W	23.1	26/10	1011.4
46002	42.5N	130.3W	0742	17.0	17.4	1.6	3.0	30/15	12.2	NW	21.0	25/02	1020.0
46003	51.9N	155.9W	0739	11.3	11.6	1.6	4.9	11/21	10.5	W	23.9	11/20	1016.8
46005	46.1N	131.0W	0739	16.1	16.6	1.5	3.1	29/10	10.7	NW	22.9	28/05	1020.3
46006	40.9N	137.5W	0732	18.8	19.6	1.6	4.8	30/02	9.0	NE	28.8	27/21	1021.9
46011	34.9N	120.9W	0741	13.5	13.9	1.5	2.9	31/08	9.4	NW	21.2	20/22	1013.2
46012	37.4N	122.7W	0742	12.8	13.1	1.5	2.9	03/03	8.8	NW	21.4	03/04	1013.6
46013	38.2N	123.3W	0730	12.0	11.2	1.7	3.3	18/04	14.1	NW	31.1	04/00	1014.5
46014	39.2N	124.0W	0743	12.4	11.9	1.8	3.5	18/00	12.2	NW	27.8	18/01	1014.2
46025	33.8N	119.1W	0737	18.3	20.1	0.9	1.7	25/05	5.5	W	14.8	24/21	1011.9
46026	37.8N	122.8W	0740	12.3	12.8	1.4	2.8	03/01	10.5	NW	25.1	03/02	1013.5
46027	41.9N	124.4W	0739	12.3	12.1	1.5	3.4	19/00	8.2	NW	33.2	31/22	1015.3
46028	35.7N	121.9W	0737	13.6	14.2	1.9	3.3	03/06	14.3	NW	29.0	03/04	1014.6
46029	46.3N	124.3W	0739	13.9	14.2	1.3	2.6	05/22	9.9	NW	20.8	09/23	1017.7
46030	40.4N	124.5W	0736	11.8	10.7	1.6	3.1	18/18	12.3	N	23.9	01/15	1016.4
46041	47.4N	124.5W	0739	12.0	1.2		2.4	05/13	7.3	NW	18.8	09/06	1017.4
46042	36.8N	122.4W	0737	15.9	13.4	1.7	2.7	22/05	9.8	NW	22.9	22/03	1014.3
46045	33.8N	118.5W	0741	18.8	20.1	0.7	1.7	25/01	5.9	NW	17.5	26/02	1011.7
46050	44.6N	124.5W	0507	13.1	11.7	1.4	2.4	09/05	3.2	N	8.4	01/04	1019.0
46051	34.5N	120.7W	0739	13.4	1.7		2.8	31/09	13.3	NW	23.3	25/08	1013.0
46053	34.2N	119.9W	0736	15.6	16.7	0.9	1.7	02/01	9.9	W	26.4	25/22	1012.0
46054	34.3N	120.5W	0736	13.9	14.5	1.6	2.5	31/12	18.3	NW	34.8	02/00	1012.6
46059	38.0N	130.0W	0743	18.0	18.2	1.7	2.8	28/11					1021.3
46060	60.6N	146.8W	1481	13.1	14.0	0.3	1.4	10/18	8.2	E	27.6	10/17	1010.8
46061	60.2N	146.8W	1483	13.9	0.8		2.5	10/19	10.7	E	26.4	10/18	1011.0
51001	23.4N	162.3W	0742	27.1	27.9	1.6	2.3	06/17	10.3	E	18.9	18/05	1017.5
51002	17.2N	157.8W	0743	26.8	27.3	1.7	2.8	13/08	14.0	E	22.3	18/07	1013.3
51003	19.1N	160.8W	0742	27.0	27.9	1.5	2.3	01/02	10.0	NE	20.5	14/04	1014.6
51004	17.4N	152.5W	0741	26.1	1.8		2.5	18/09	12.8	NE	20.0	18/07	1014.7
51026	21.4N	156.9W	0737	26.0	26.8	1.4	2.3	06/20					1016.6
91204	9.9N	139.7E	0551	28.8					4.3	N	23.3	12/02	1009.9
91222	18.1N	145.8E	0712	28.0									1009.6
91251	11.4N	162.4E	0724	28.5					7.1	E	26.8	21/16	1009.6
91328	8.6N	149.7E	0740	28.1					5.1	NE	18.0	02/05	1012.0
91338	5.3N	153.7E	0356	29.7					3.0	N	15.5	01/19	1009.8
91343	7.6N	155.2E	0738	28.2									1008.3
91352	6.2N	160.7E	0741	27.8					4.7	E	21.6	25/17	1010.6

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BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	MAX SIG WAVE HT (DA/HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA/HR)	MEAN PRESS (MB)
91355	5.4N	163.0E	0743	26.7					5.1	E	16.8	25/00	1009.2
91374	8.7N	171.2E	0461	27.5					3.6	NE	13.8	16/19	1010.7
91377	6.1N	172.1E	0492	28.1					6.3	NE	19.4	09/19	1012.7
91411	8.3N	137.5E	0643	28.4									1009.7
91442	4.6N	168.7E	0731	28.3					7.6	E	30.7	23/17	1010.1
ABAN6	44.3N	075.9W	0739	20.7	21.7				3.2	S	14.7	28/02	1019.0
ALSN6	40.5N	073.8W	0738	21.8	0.6		1.9	13/17	10.0	S	27.4	13/15	1019.2
BLIA2	60.8N	146.9W	1483	12.0					7.5	NW	22.3	29/16	1011.6
BURL1	28.9N	089.4W	0743	28.4					8.3	E	32.7	21/21	1018.5
BUSL1	27.9N	090.9W	0594	29.0					6.9	E	29.0	22/14	1016.9
CARO3	43.3N	124.4W	0740	15.3					6.2	NE	19.4	06/19	1017.5
CDRF1	29.1N	083.0W	0744	27.1					7.3	NE	22.3	12/03	1017.8
CHLV2	36.9N	075.7W	0739	23.8	24.5	0.7	2.1	31/23	8.6	NE	27.1	13/05	1019.3
CLKN7	34.6N	076.5W	0738	25.8					8.6	NE	24.5	31/21	1018.6
CSBF1	29.7N	085.4W	0738	27.3					6.2	NE	25.8	12/10	1017.6
DBLN6	42.5N	079.4W	0740	21.4					6.8	SE	23.6	27/15	1018.9
DESW1	47.7N	124.5W	0742	12.9					9.4	NW	30.2	08/02	1017.7
DISW3	47.1N	090.7W	0741	18.8					9.0	SW	33.4	07/07	1017.1
DPIA1	30.3N	088.1W	0742	27.4	29.9				7.5	SW	24.0	21/08	1017.5
DRYF1	24.6N	082.9W	0737	28.5					8.5	E	27.2	19/02	1016.9
DSLN7	35.2N	075.3W	0742	25.3	0.9		3.5	31/10	10.9	NE	38.7	13/08	1018.2
DUCN7	36.2N	075.8W	0739	24.3	0.6		2.2	31/23	8.4	NE	25.1	12/23	1019.9
FBIS1	32.7N	079.9W	0743	26.6					7.5	E	21.9	12/06	1018.5
FFIA2	57.3N	133.6W	0739	11.5					7.9	SE	23.6	21/19	1014.4
FWYF1	25.6N	080.1W	0740	28.8	29.3				10.5	E	28.1	18/23	1017.8
GDIL1	29.3N	090.0W	0739	28.1	30.5				7.2	E	23.7	12/08	1017.3
IOSN3	43.0N	070.6W	0738	18.6					9.5	S	24.1	25/20	1018.2
KTNF1	29.8N	083.6W	0741	26.0					7.1	NE	24.4	01/15	1017.4
LKWF1	26.6N	080.0W	0737	27.7	29.1				8.5	E	21.1	19/02	1017.5
LONF1	24.9N	080.9W	0739	28.5	30.1				9.3	E	24.8	20/23	1017.6
MDRM1	44.0N	068.1W	0740	14.5					10.6	SW	26.2	26/00	1018.3
MISM1	43.8N	068.9W	0742	14.9					10.3	SW	26.8	26/00	1018.4
MLRF1	25.0N	080.4W	0732	28.3	29.6				9.5	E	23.1	17/06	1017.4
NWPO3	44.6N	124.1W	0733	11.9					7.7	N	25.9	13/00	1017.0
POTA2	61.1N	146.7W	1485	11.2					9.3	N	22.7	15/13	1011.3
PTAC1	39.0N	123.7W	0742	11.9					10.7	N	24.3	11/07	1014.8
PTAT2	27.8N	097.1W	0741	27.9	29.5				12.8	SE	30.4	27/10	1015.7
ROAM4	47.9N	089.3W	0741	15.8					12.8	SW	34.4	05/19	1016.2
SANF1	24.5N	081.9W	0742	28.5	29.6				9.6	E	29.5	06/06	1016.5
SAUF1	29.9N	081.3W	0739	25.5	25.9				7.0	E	21.3	31/10	1018.4
SBIO1	41.6N	082.8W	0743	23.3					7.2	E	23.6	16/01	1019.1
SGNW3	43.8N	087.7W	0741	19.7					8.0	S	25.1	07/11	1018.9
SISW1	48.3N	122.9W	0729	13.6					9.0	W	35.0	05/05	1017.1
SMKF1	24.6N	081.1W	0741	28.8	30.0				10.5	E	29.0	21/00	1017.3
SPGF1	26.7N	079.0W	0741	27.9					5.5	SE	19.3	21/01	1018.1
SRST2	29.7N	094.1W	0743	27.5					9.4	S	23.3	26/22	1016.8
STDM4	47.2N	087.2W	0738	16.0					14.5	S	32.9	05/16	1018.0
SUPN6	44.5N	075.8W	0028	19.0	20.4				8.3	S	13.3	01/01	1013.6
SVLS1	32.0N	080.7W	0738	26.5	28.6	0.6	2.1	30/23	10.6	NE	27.6	28/03	1018.0
THIN6	44.3N	076.0W	0740	20.3									
TPLM2	38.9N	076.4W	0735	23.9	25.6				7.6	S	30.9	13/08	1018.9
TTIW1	48.4N	124.7W	0739	13.0					9.1	S	29.9	27/00	1017.9
VENF1	27.1N	082.5W	0742	26.9	30.2				6.9	E	19.4	12/22	1018.1
WPOW1	47.7N	122.4W	0479	15.3					7.6	NE	23.4	11/15	1018.2
JULY 1996													
41001	34.7N	072.6W	0737	25.3	25.8	1.7	5.3	13/04	12.0	S	27.6	20/07	1016.8
41002	32.4N	075.3W	0243	27.1	27.7				10.8	SW	19.8	22/15	1019.3
41004	32.5N	079.1W	0738	26.9	27.1	1.4	7.7	12/08	13.0	SW	38.7	12/11	1016.5
41009	28.5N	080.2W	1482	27.2	27.4	0.8	3.7	11/13	9.8	S	25.5	09/22	1018.0
41010	28.9N	078.5W	1480	27.0	27.2	1.2	6.3	11/07	10.4	SW	35.6	11/09	1017.4
41021	31.9N	080.9W	0481	27.5	28.3	0.6	2.1	05/18	13.0	SW	31.9	05/18	1015.9
41022	31.9N	080.9W	0739	27.5	28.4	0.7	2.2	05/19	13.4	SW	32.6	05/18	1016.3
41023	31.9N	080.9W	0742	27.5	28.4	0.3	1.3	11/21	11.9	SW	30.9	05/18	1016.6
42001	25.9N	089.7W	0741	28.6	29.5	0.8	1.9	02/14	9.4	E	22.5	08/04	1016.5
42002	25.9N	093.6W	0740	28.9	29.7	0.7	1.7	08/09	9.2	SE	18.7	27/05	1015.6
42003	25.9N	085.9W	0738	28.6	29.5	0.8	2.4	05/18	9.6	E	27.2	05/17	1016.7
42007	30.1N	088.8W	0741	28.7	30.0				10.1	SW	26.8	08/15	1016.4
42019	27.9N	095.0W	0742	28.8	0.8		1.9	08/19	8.5	S	18.5	08/11	1015.5
42020	27.0N	096.5W	0743	28.7	1.0		1.7	09/21	11.4	SE	29.2	24/08	1014.9
42035	29.3N	094.4W	0737	29.2	30.3	0.7	1.4	08/17	9.5	S	19.6	26/18	1015.5
42036	28.5N	084.5W	0729	28.3	29.0	0.7	2.3	06/00	8.7	S	25.8	05/10	1017.1
42039	28.8N	086.0W	0743	29.5	0.8		2.0	06/07	9.0	S	22.0	07/14	1018.2
42040	29.2N	088.3W	0736	28.5	29.7	0.7	1.7	07/17	8.7	SW	24.7	08/16	1017.6
44004	38.5N	070.7W	0739	22.9	23.5	1.4	5.9	13/17	11.6	SW	31.7	13/18	1015.4
44005	42.9N	069.0W	0738	17.2	14.4	1.3	4.6	14/04	10.7	S	31.9	14/03	1011.9
44007	43.5N	070.2W	0737	16.1	14.4	0.8	2.5	14/03	7.6	S	25.6	20/17	1011.1
44008	40.5N	069.4W	0499	15.8	13.7	1.3	6.7	14/01	8.9	SW	24.5	14/00	1016.7
44009	38.5N	074.7W	0740	21.9	21.8	0.9	4.5	13/12	10.6	S	37.9	13/12	1013.9

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Buoy Climatological Data Summary

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BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	MAX SIG WAVE HT (DA/HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA/HR)	MEAN PRESS (MB)
44011	41.1N	066.6W	0736	15.0	13.2	1.4	5.4	14/06	9.6	SW	24.5	14/05	1013.8
44013	42.4N	070.7W	0727	18.1	16.3	0.4	2.0	13/22	8.6	S	22.5	13/19	1012.2
44014	36.6N	074.8W	0731	23.0	22.4	1.1	5.3	13/04	9.9	SW	34.0	13/08	1015.2
44025	40.3N	073.2W	0738	20.3	19.9	1.0	5.5	13/19	11.0	S	32.8	13/18	1013.5
44028	41.4N	071.1W	0735	18.6	17.7	0.9	4.7	14/00	11.1	SW	35.9	13/23	1013.2
45001	48.1N	087.8W	0741	6.4	3.4	0.4	1.2	23/19	9.1	SW	19.0	08/13	1013.3
45002	45.3N	086.4W	0738	14.2	13.2	0.4	1.6	22/20	8.6	S	24.1	18/15	1013.2
45003	45.3N	082.8W	0744	11.3	8.8	0.3	1.1	19/16	8.0	W	19.2	20/00	1013.2
45004	47.6N	086.5W	0742	6.1	3.3	0.4	1.2	19/14	8.0	W	18.7	19/13	1013.8
45005	41.7N	082.4W	0740	21.6	22.0				9.4	SW	24.7	20/00	1013.3
45006	47.3N	089.9W	0743	7.3	3.7	0.3	1.2	06/08	8.0	SW	19.6	06/07	1013.3
45007	42.7N	087.0W	0723	15.7	13.7	0.4	2.5	19/21	6.9	S	23.7	19/21	1013.6
45008	44.3N	082.4W	0737	14.8	13.3	0.3	1.4	19/17	7.2	S	20.4	20/01	1013.7
46001	56.3N	148.2W	0743	10.4	10.8	1.5	3.7	05/16	11.3	SW	22.3	05/17	1017.9
46002	42.5N	130.3W	0743	15.0	15.9	2.0	3.9	15/14	15.2	NW	24.9	15/15	1021.9
46003	51.9N	155.9W	0734	9.5	9.6	1.6	3.8	10/18	9.6	W	22.5	04/08	1017.5
46005	46.1N	131.0W	0737	13.5	14.3	1.7	3.9	15/05	12.1	N	25.3	14/05	1023.8
46006	40.9N	137.5W	0741	16.9	17.2	1.5	3.2	15/03	10.0	N	20.8	14/16	1026.3
46011	34.9N	120.9W	0740	13.3	14.0	1.5	2.8	05/22	8.3	NW	24.9	04/20	1013.6
46012	37.4N	122.7W	0740	12.6	13.3	1.4	2.8	19/04	7.8	NW	22.5	19/01	1013.6
46013	38.2N	123.3W	0725	11.5	11.4	1.6	2.9	05/05	10.3	NW	29.1	19/01	1015.0
46014	39.2N	124.0W	0742	12.1	12.2	2.0	4.0	09/03	10.6	NW	29.0	09/06	1014.1
46023	34.3N	120.7W	0107	13.7	14.1	1.6	2.6	10/04	9.4	NW	18.5	15/07	1014.1
46025	33.8N	119.1W	0728	16.9	18.4	0.9	2.0	25/09	5.4	W	15.3	07/01	1012.6
46026	37.8N	122.8W	0740	12.1	13.0	1.4	2.5	05/13	8.6	NW	21.8	19/05	1013.8
46027	41.9N	124.4W	0735	11.2	10.7	1.9	3.6	06/02	9.1	NW	29.3	05/23	1014.7
46028	35.7N	121.9W	0741	13.3	14.1	1.8	3.3	10/02	10.9	NW	27.2	04/07	1015.1
46029	46.3N	124.3W	0740	13.9	14.4	1.6	3.7	15/14	10.6	NW	22.2	13/09	1018.1
46030	40.4N	124.5W	0739	11.3	10.3	2.0	3.3	06/05	11.9	N	24.7	09/11	1015.9
46041	47.4N	124.5W	0733	12.8	1.4		3.1	15/08	8.2	NW	20.0	18/14	1017.8
46042	36.8N	122.4W	0739	15.4	13.1	1.7	3.4	09/21	8.5	NW	22.7	19/00	1014.5
46045	33.8N	118.5W	0740	17.2	19.2	0.7	1.5	07/06	5.8	NW	13.4	23/06	1012.4
46050	44.6N	124.5W	0739	13.5	11.9	1.9	3.6	15/19	10.2	N	23.3	22/03	1017.7
46051	34.5N	120.7W	0738	13.1	1.6		3.0	10/08	12.2	NW	25.6	24/11	1013.4
46053	34.2N	119.9W	0725	14.9	16.1	0.8	2.1	06/00	9.5	W	22.5	07/03	1012.6
46054	34.3N	120.5W	0731	13.5	14.0	1.5	2.7	04/23	16.2	NW	31.5	05/06	1013.1
46059	38.0N	130.0W	0736	16.4	16.8	2.2	3.3	06/14					1021.7
46060	60.6N	146.8W	1482	12.9	13.3	0.4	1.2	06/17	7.6	E	22.7	13/05	1018.4
46061	60.2N	146.8W	1448	12.6	13.4	0.8	2.3	01/01	8.4	E	25.1	13/06	1018.6
51001	23.4N	162.3W	0741	26.4	27.2	2.0	3.5	20/07	13.9	E	22.0	04/20	1018.8
51002	17.2N	157.8W	0744	26.5	27.0	2.0	2.9	31/20	15.5	E	21.9	29/16	1013.9
51003	19.1N	160.8W	0743	26.5	27.3	1.9	3.2	23/21	11.7	NE	21.7	16/22	1015.2
51004	17.4N	152.5W	0743	25.9	2.0		3.2	23/10	14.3	E	21.0	30/19	1015.5
51026	21.4N	156.9W	0732	25.5	26.0	1.8	3.1	05/17					1017.4
91204	9.9N	139.7E	0501	29.2					5.5	NE	19.4	28/21	1009.0
91222	18.1N	145.8E	0683	28.3									1008.6
91251	11.4N	162.4E	0730	28.2					11.2	E	23.0	21/06	1009.0
91328	8.6N	149.7E	0741	28.2					5.5	NE	17.5	29/17	1010.9
91338	5.3N	153.7E	0487	27.7					3.3	N	21.3	07/03	1008.7
91343	7.6N	155.2E	0741	28.2									1008.3
91352	6.2N	160.7E	0743	27.9					6.0	E	21.9	12/07	1009.4
91355	5.4N	163.0E	0742	27.1					5.3	E	15.4	12/03	1008.1
91377	6.1N	172.1E	0482	27.8					7.6	NE	27.2	22/18	1011.6
91411	8.3N	137.5E	0668	27.9									1008.7
ABAN6	44.3N	075.9W	0735	19.7	18.1				3.1	S	13.0	30/16	1012.6
ALSN6	40.5N	073.8W	0736	21.1	19.2	0.7	2.4	13/20	14.0	S	44.3	13/15	1013.6
BLIA2	60.8N	146.9W	1482	11.8					6.3	NW	20.5	14/02	1019.1
BURL1	28.9N	089.4W	0742	28.9					8.9	SE	24.4	08/12	1018.0
BUSL1	27.9N	090.9W	0681	29.1					7.7	S	27.9	07/15	1016.4
CARO3	43.3N	124.4W	0741	12.1					8.2	N	22.1	10/18	1017.5
CDRF1	29.1N	083.0W	0737	28.1					8.6	SW	25.7	31/02	1018.0
CHLV2	36.9N	075.7W	0741	23.8	23.3	0.9	3.7	13/08	13.2	SW	48.7	13/07	1015.2
CLKN7	34.6N	076.5W	0738	26.3					12.1	SW	52.7	12/18	1015.8
CSBF1	29.7N	085.4W	0079	28.6					7.5	S	12.4	15/04	1016.6
DBLN6	42.5N	079.4W	0740	20.4					9.1	SW	29.1	19/15	1013.5
DESW1	47.7N	124.5W	0743	13.1					9.3	NW	30.5	07/01	1018.1
DISW3	47.1N	090.7W	0734	14.1					9.8	SW	27.4	06/08	1014.2
DPIA1	30.3N	088.1W	0735	28.6	30.2				8.1	SW	21.7	23/21	1017.0
DRYF1	24.6N	082.9W	0729	28.9					10.1	E	29.9	05/19	1017.6
DSLN7	35.2N	075.3W	0739	25.4	0.8		3.6	11/15	17.0	SW	58.7	12/23	1015.4
DUCN7	36.2N	075.8W	0729	24.9					11.5	SW	42.6	13/06	1016.1
FBIS1	32.7N	079.9W	0744	27.3					10.2	SW	32.5	12/08	1016.3
FFIA2	57.3N	133.6W	0741	12.4					6.9	S	24.9	14/21	1019.9
FWYF1	25.6N	080.1W	0735	28.6	29.1				12.5	E	29.3	16/11	1018.4
GDIL1	29.3N	090.0W	0732	28.9	30.9				7.5	SE	21.1	24/00	1016.7
IOSN3	43.0N	070.6W	0729	18.0					12.5	S	37.0	13/22	1011.6
KTNF1	29.8N	083.6W	0733	27.5					10.1	SW	34.5	05/20	1017.4
LKWF1	26.6N	080.0W	0740	28.1	28.8				10.0	SE	22.5	16/09	1018.1
LONF1	24.9N	080.9W	0736	28.7	30.3				10.9	E	25.8	10/02	1018.4
MDRM1	44.0N	068.1W	0739	13.2					14.2	SW	32.7	14/06	1011.8
MISM1	43.8N	068.9W	0740	13.9					13.9	SW	35.2	14/01	1011.8

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BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	MAX SIG WAVE HT (DA/HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA/HR)	MEAN PRESS (MB)
MLRF1	25.0N	080.4W	0318	28.4	29.3				11.4	E	21.4	27/06	1020.1
NWPO3	44.6N	124.1W	0737	11.8					9.5	N	28.7	07/01	1017.1
PILM4	48.2N	088.4W	0739	10.3					12.1	W	29.0	05/15	1012.4
POTA2	61.1N	146.7W	1474	12.1					6.7	N	22.6	03/13	1018.7
PTAC1	39.0N	123.7W	0743	11.7					8.8	N	23.2	09/07	1014.7
PTAT2	27.8N	097.1W	0743	28.3	30.2				12.8	SE	23.4	15/04	1015.2
ROAM4	47.9N	089.3W	0736	12.7					13.3	NE	33.3	18/22	1013.3
SANF1	24.5N	081.9W	0739	28.6	29.3				11.0	E	23.1	27/07	1017.3
SAUF1	29.9N	081.3W	0738	26.6	27.0				8.4	SW	29.2	11/23	1018.0
SBIO1	41.6N	082.8W	0742	22.1					9.5	NW	24.4	19/07	1014.2
SGNW3	43.8N	087.7W	0739	17.7					8.3	S	22.9	19/19	1014.6
SISW1	48.3N	122.9W	0736	13.7					8.7	W	34.3	09/04	1017.5
SMKF1	24.6N	081.1W	0737	28.9	29.9				11.9	E	30.1	17/04	1018.1
SPGF1	26.7N	079.0W	0733	28.3					6.5	S	21.6	10/19	1018.7
SRST2	29.7N	094.1W	0741	29.1					10.4	S	27.2	16/10	1016.0
STDM4	47.2N	087.2W	0738	12.3					16.1	NW	33.6	05/14	1014.6
SUPN6	44.5N	075.8W	0201	19.4	18.3				9.6	SW	20.3	30/18	1011.2
SVLS1	32.0N	080.7W	0738	27.6	28.3	0.8	2.7	11/21	14.4	SW	32.0	05/18	1016.5
THIN6	44.3N	076.0W	0741	19.4									
TPLM2	38.9N	076.4W	0740	23.9	24.5				9.8	S	29.1	13/17	1014.0
TTIW1	48.4N	124.7W	0741	13.0					9.3	S	26.6	28/19	1018.4
VENF1	27.1N	082.5W	0740	27.9	30.9				7.6	E	27.9	04/10	1018.6
WPOW1	47.7N	122.4W	0739	15.6					8.3	NE	22.2	19/19	1017.8

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41001	34.7N	072.6W	0714	23.4	24.1	1.3	3.3	02/23	12.2	S	26.4	03/22	1017.7
41004	32.5N	079.1W	0714	25.5	26.0	1.1	3.0	19/02	10.3	SW	25.6	18/22	1017.1
41009	28.5N	080.2W	1435	26.0	26.5	0.9	2.9	01/03	9.8	S	22.7	01/00	1016.3
41010	28.9N	078.5W	1432	25.8	26.5	1.3	4.1	18/02	9.6	SE	25.5	26/19	1016.0
41021	31.9N	080.9W	0717	25.8	27.0	0.7	1.4	27/00	11.1	S	22.2	27/00	1016.5
41022	31.9N	080.9W	0720	25.8	26.9	0.7	1.5	01/09	11.1	S	21.6	27/09	1016.4
41023	31.9N	080.9W	0719	25.8	27.4	0.3	1.1	27/20	10.6	S	22.0	27/09	1016.6
42001	25.9N	089.7W	0716	27.4	28.3	0.6	1.6	22/16	8.8	E	33.0	08/11	1015.6
42002	25.9N	093.6W	0715	27.7	28.3	0.8	3.3	24/12	10.5	SE	37.1	24/11	1014.6
42003	25.9N	085.9W	0711	27.5	28.6	0.6	2.2	02/16	8.9	E	30.9	08/16	1015.1
42007	30.1N	088.8W	0720	27.1	28.8				8.5	S	21.4	01/23	1015.6
42019	27.9N	095.0W	0717	27.3	0.9	2.6		24/22	9.4	SE	26.0	23/05	1014.4
42020	27.0N	096.5W	0715	27.5	1.0	2.7		23/19	11.2	SE	22.2	11/04	1013.8
42035	29.3N	094.4W	0712	27.5	28.6	0.8	1.9	23/10	10.4	S	23.7	22/18	1014.4
42036	28.5N	084.5W	0443	27.7	28.2	0.5	1.7	29/15	7.9	W	26.6	28/23	1015.0
42039	28.8N	086.0W	0718	27.7	0.6	2.3		01/11	7.4	E	22.0	01/05	1017.3
42040	29.2N	088.3W	0716	27.2	28.7	0.5	2.3	01/22	7.1	SW	22.5	08/01	1016.8
44004	38.5N	070.7W	0712	20.9	21.0	1.2	3.5	04/09	9.8	S	23.6	29/07	1017.5
44005	42.9N	069.0W	0714	13.7	11.4	0.9	2.5	26/14	9.3	S	27.6	21/21	1015.8
44007	43.5N	070.2W	0717	14.3	13.0	0.7	2.0	22/04	7.9	S	24.3	26/14	1015.1
44009	38.5N	074.7W	0712	20.0	19.7	0.8	2.1	03/16	9.0	S	20.8	30/19	1016.3
44011	41.1N	066.6W	0711	12.0	10.3	1.1	2.7	22/08	8.4	S	19.0	22/06	1016.5
44013	42.4N	070.7W	0680	16.8	15.6	0.5	1.8	22/21	7.8	S	19.8	26/12	1015.9
44014	36.6N	074.8W	0711	20.9	20.1	1.0	2.7	03/11	8.6	S	22.0	26/06	1017.0
44025	40.3N	073.2W	0714	18.7	18.3	0.8	2.2	04/18	9.2	S	21.2	22/22	1016.3
44028	41.4N	071.1W	0713	16.4	15.3	0.6	1.9	04/18	9.9	S	21.8	04/17	1016.6
45001	48.1N	087.8W	0716	5.4	2.6	0.3	1.2	02/21	7.7	SW	17.9	02/20	1014.1
45002	45.3N	086.4W	0715	6.9	3.4	0.4	1.6	02/12	8.3	S	22.0	02/09	1014.0
45003	45.3N	082.8W	0712	6.4	2.8	0.4	2.0	02/17	8.4	SE	21.2	02/14	1014.4
45004	47.6N	086.5W	0718	5.3	2.4	0.4	1.4	02/13	7.3	E	18.3	02/11	1014.8
45005	41.7N	082.4W	0713	18.9	17.4				7.5	SW	23.5	25/03	1013.8
45006	47.3N	089.9W	0717	5.8	2.6	0.3	1.3	17/17	7.6	NE	18.5	17/16	1013.7
45007	42.7N	087.0W	0710	8.0	3.5	0.3	1.2	07/17	6.9	S	19.6	02/04	1013.3
45008	44.3N	082.4W	0713	8.2	4.8	0.3	1.4	02/16	6.9	NE	19.4	02/14	1014.8
46001	56.3N	148.2W	0706	8.2	8.8	1.7	3.7	27/00	10.8	SW	23.1	13/15	1012.6
46002	42.5N	130.3W	0713	13.2	14.1	1.7	3.6	07/00	11.2	NW	20.8	23/19	1021.8
46003	51.9N	155.9W	0711	7.1	7.1	2.0	5.6	26/11	11.4	W	22.5	16/20	1015.2
46005	46.1N	131.0W	0709	11.6	11.9	1.8	4.6	06/18	11.3	W	22.7	06/00	1021.1
46006	40.9N	137.5W	0714	13.6	14.2	1.7	4.4	06/08	10.2	W	24.9	02/18	1023.9
46011	34.9N	120.9W	0714	12.2	12.2	1.9	3.3	18/03	11.5	NW	23.5	10/20	1013.6
46012	37.4N	122.7W	0719	11.5	11.6	2.0	3.4	15/21	11.6	NW	22.2	18/00	1014.3
46013	38.2N	123.3W	0716	10.9	9.3	2.2	3.8	22/04	20.1	NW	30.9	22/01	1014.6
46014	39.2N	124.0W	0713	11.4	10.1	2.3	4.8	15/14	15.1	NW	29.7	22/01	1015.2
46025	33.8N	119.1W	0702	16.6	18.6	1.0	1.9	22/04	5.9	W	17.3	25/23	1012.4
46026	37.8N	122.8W	0709	10.8	10.5	1.9	3.2	22/01	13.7	NW	26.8	17/14	1013.9
46027	41.9N	124.4W	0710	10.6	9.2	1.7	4.2	15/01	11.2	NW	33.2	16/00	1016.8
46028	35.7N	121.9W	0714	11.9	11.8	2.3	4.1	10/01	17.4	NW	30.7	10/02	1014.9
46029	46.3N	124.3W	0716	12.9	13.8	1.4	2.6	07/12	9.7	NW	21.8	19/21	1019.6
46030	40.4N	124.5W	0712	11.0	9.6	1.7	3.8	16/17	14.0	N	36.4	15/11	1018.2
46035	57.0N	177.7W	0673	5.8	5.9	1.7	6.8	24/00	14.2	SW	37.3	23/22	
46041	47.4N	124.5W	0717	19.0	12.5	1.3	2.8	07/16	8.1	NW	18.8	14/00	1019.1
46042	36.8N	122.4W	0720	14.0	11.1	2.0	3.3	09/23	13.2	NW	23.5	19/00	1015.0
46045	33.8N	118.5W	0714	16.9	18.2	0.8	1.5	22/07	5.8	NW	18.5	26/00	1012.2
46050	44.6N	124.5W	0707	13.5	13.5	1.5	2.7	12/10	10.2	N	23.5	19/22	1019.5

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BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	MAX SIG WAVE HT (DA/HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA/HR)	MEAN PRESS (MB)
46051	34.5N	120.7W	0715	12.4	2.0	3.4		18/06	14.0	NW	25.5	18/06	1013.4
46053	34.2N	119.9W	0703	14.5	15.3	1.1	2.0	11/02	9.3	W	26.6	22/03	1012.4
46054	34.3N	120.5W	0717	12.8	13.0	1.9	3.3	18/06	18.0	NW	33.4	18/03	1013.1
46059	38.0N	130.0W	0711	15.2	15.9	1.8	2.9	15/09	7.2	N	13.8	04/14	1023.3
46060	60.6N	146.8W	1436	10.8	11.5	0.4	1.1	11/04	9.2	E	23.5	12/09	1012.7
46061	60.2N	146.8W	1412	10.6	11.0	1.0	2.5	05/21	9.5	SE	28.6	12/04	1013.0
51001	23.4N	162.3W	0429	26.3	27.2	1.9	3.0	20/05	13.3	E	22.7	30/11	1019.9
51002	17.2N	157.8W	0716	26.3	26.8	2.0	3.1	25/21	14.5	E	22.4	05/05	1014.6
51003	19.1N	160.8W	0714	26.5	27.3	1.8	2.8	26/07	10.6	NE	18.3	19/20	1015.8
51004	17.4N	152.5W	0715	25.8	2.1	2.8		16/22	14.0	E	21.5	24/23	1016.0
51026	21.4N	156.9W	0707	25.3	25.7	1.6	2.5	19/14					1017.8
91204	9.9N	139.7E	0544	28.4					9.1	E	27.2	15/19	1010.2
91222	18.1N	145.8E	0708	28.9									1012.0
91251	11.4N	162.4E	0700	28.0					12.8	E	25.5	06/06	1010.2
91328	8.6N	149.7E	0714	28.1					6.4	NE	16.6	10/23	1011.9
91338	5.3N	153.7E	0492	27.8					3.8	NE	21.3	05/15	1009.6
91343	7.6N	155.2E	0713	28.1					11.2	NE	19.3	04/05	1009.3
91352	6.2N	160.7E	0714	27.4					7.0	NE	22.0	04/22	1010.4
91355	5.4N	163.0E	0718	26.9					5.4	E	23.0	01/06	1009.0
91377	6.1N	172.1E	0486	27.6					8.4	NE	21.3	13/07	1012.4
91411	8.3N	137.5E	0706	27.7									1008.8
ABAN6	44.3N	075.9W	0718	17.7	13.4				3.2	S	13.8	02/16	1015.5
ALSN6	40.5N	073.8W	0715	19.3	17.4	0.7	2.4	03/20	13.8	S	31.6	05/02	1016.4
BLIA2	60.8N	146.9W	1434	10.8					7.7	S	28.7	04/09	1013.4
BURL1	28.9N	089.4W	0715	27.2					7.2	S	23.7	28/18	1017.1
BUSL1	27.9N	090.9W	0699	27.7					6.5	S	33.8	21/23	1015.7
CARO3	43.3N	124.4W	0715	12.3					8.6	N	24.0	16/10	1019.4
CDRF1	29.1N	083.0W	0716	26.4					7.9	NE	24.1	29/19	1016.4
CHLV2	36.9N	075.7W	0718	22.0	21.2	0.7	2.1	03/15	12.4	S	31.2	25/07	1017.2
CLKN7	34.6N	076.5W	0717	24.4					10.7	SW	26.9	09/13	1017.3
DBLN6	42.5N	079.4W	0716	18.6					7.3	SW	26.7	30/10	1014.8
DESW1	47.7N	124.5W	0715	12.1					8.9	NW	26.9	20/02	1019.4
DISW3	47.1N	090.7W	0715	13.2					8.9	SW	26.5	17/14	1014.3
DPIA1	30.3N	088.1W	0714	26.9	28.9				7.5	S	23.3	01/14	1016.2
DRYF1	24.6N	082.9W	0711	27.7					7.3	E	22.2	02/08	1015.9
DSLN7	35.2N	075.3W	0713	23.6	0.9	1.6		09/15	16.0	SW	37.1	20/07	1016.9
DUCN7	36.2N	075.8W	0712	23.1					10.6	SE	26.7	03/15	1017.9
FBIS1	32.7N	079.9W	0712	25.7					9.4	SW	25.0	11/07	1016.9
FFIA2	57.3N	133.6W	0676	10.9					7.7	E	37.0	30/10	1014.5
FWYF1	25.6N	080.1W	0717	26.9	28.1				10.3	E	28.3	27/18	1016.4
GDIL1	29.3N	090.0W	0712	27.5	29.9				6.9	S	26.1	08/08	1015.9
IOSN3	43.0N	070.6W	0676	16.4					11.2	S	28.2	26/15	1015.4
KTNF1	29.8N	083.6W	0717	25.8					8.1	NE	22.6	09/15	1016.1
LKWF1	26.6N	080.0W	0714	26.1	27.6				9.0	NE	22.6	10/06	1016.2
LONF1	24.9N	080.9W	0717	27.6	29.6				8.7	E	24.1	10/09	1016.6
MDRM1	44.0N	068.1W	0716	11.3					12.4	S	28.0	22/00	1015.9
MISM1	43.8N	068.9W	0717	12.0					12.8	S	27.0	21/21	1015.9
MLRF1	25.0N	080.4W	0519	27.0	28.1				10.0	E	25.7	01/23	1016.1
NWPO3	44.6N	124.1W	0713	11.9					8.8	N	28.6	20/02	1019.0
PILM4	48.2N	088.4W	0711	8.3					10.2	E	27.4	30/16	1014.5
POTA2	61.1N	146.7W	1432	11.1					6.9	SW	28.9	04/17	1013.0
PTAC1	39.0N	123.7W	0715	10.8					13.4	N	24.1	11/09	1015.8
PTAT2	27.8N	097.1W	0714	27.4	29.2				13.8	SE	30.0	07/17	1014.0
ROAM4	47.9N	089.3W	0712	11.2					10.5	NE	31.7	29/13	1013.9
SANF1	24.5N	081.9W	0719	27.6	28.5				8.4	E	26.8	02/03	1015.6
SAUF1	29.9N	081.3W	0716	25.1	26.8				9.0	E	27.4	27/21	1016.8
SBIO1	41.6N	082.8W	0716	20.2					9.0	E	29.0	04/20	1014.6
SGNW3	43.8N	087.7W	0716	14.3					9.5	N	30.3	07/12	1014.5
SISW1	48.3N	122.9W	0716	11.8					10.0	W	29.2	16/05	1018.7
SMKF1	24.6N	081.1W	0717	27.8	29.0				9.5	E	35.8	10/03	1016.3
SPGF1	26.7N	079.0W	0716	26.5					6.0	E	26.0	21/22	1016.7
SRST2	29.7N	094.1W	0716	27.1					10.8	S	26.0	20/11	1015.0
STDM4	47.2N	087.2W	0714	11.4					13.8	E	33.0	30/19	1015.3
SUPN6	44.5N	075.8W	0714	17.6	14.2				6.8	S	21.3	05/19	1016.1
SVLS1	32.0N	080.7W	0715	23.2	26.4	0.8	1.8	27/03	11.2	S	25.3	27/13	1016.6
THIN6	44.3N	076.0W	0711	17.8									
TPLM2	38.9N	076.4W	0715	22.7	22.7				10.0	S	33.6	24/22	1016.5
TTIW1	48.4N	124.7W	0718	11.6					8.2	S	27.3	10/21	1019.6
VENF1	27.1N	082.5W	0719	26.3	29.5				7.8	E	19.7	18/01	1016.7
WPOW1	47.7N	122.4W	0714	13.1					8.5	N	22.1	11/02	1019.1

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41001	34.7N	072.6W	0740	21.0	22.5	1.6	4.1	01/04	12.8	SW	27.8	12/14	1017.7
41004	32.5N	079.1W	0738	22.3	22.5	1.0	2.4	15/07	9.7	SW	23.5	30/14	1018.4
41009	28.5N	080.2W	1479	24.8	24.8	0.8	2.7	31/22	9.5	SE	23.9	14/22	1017.7
41010	28.9N	078.5W	1483	24.3	25.4	1.1	2.8	01/01	9.1	SE	23.3	22/05	1017.8
41021	31.9N	080.9W	0740	23.2	23.9	0.6	1.6	31/09	10.9	S	22.9	30/18	1017.9
41022	31.9N	080.9W	0742	23.2	23.9	0.6	1.8	31/09	10.9	S	22.7	30/18	1017.7
41023	31.9N	080.9W	0741	23.4	24.7	0.3	1.2	31/10	10.8	S	22.0	31/09	1018.0

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BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	MAX SIG WAVE HT (DA/HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA/HR)	MEAN PRESS (MB)
42001	25.9N	089.7W	0742	25.5	26.0	1.0	2.2	28/19	10.5	E	20.6	27/11	1016.1
42002	25.9N	093.6W	0737	25.3	25.4	1.1	2.2	28/02	12.6	SE	21.4	27/06	1014.4
42003	25.9N	085.9W	0735	26.1	27.4	0.9	3.0	21/23	11.3	E	28.6	21/05	1015.7
42007	30.1N	088.8W	0742	24.7	26.4				10.6	SE	28.2	29/20	1016.9
42019	27.9N	095.0W	0739	24.6	24.2	1.1	2.0	27/07	12.2	SE	19.2	04/01	1014.1
42020	27.0N	096.5W	0736	24.9	1.3	2.1		27/09	13.6	SE	22.5	01/08	1013.1
42035	29.3N	094.4W	0738	24.6	25.3	0.9	2.1	30/02	13.2	SE	27.8	30/00	1014.5
42039	28.8N	086.0W	0738	25.1	24.7	0.6	2.1	15/11	7.3	E	19.6	15/09	1018.5
42040	29.2N	088.3W	0736	24.5	25.3	0.6	1.8	15/19	7.8	SE	18.8	29/21	1017.9
44004	38.5N	070.7W	0735	13.6	13.6	1.5	4.0	01/08	11.3	SW	26.6	06/11	1017.7
44005	42.9N	069.0W	0736	8.3	7.0	1.1	3.0	13/05	10.4	SW	28.4	13/01	1014.8
44007	43.5N	070.2W	0739	9.8	9.1	0.8	2.1	01/04	8.5	S	21.8	12/04	1014.4
44008	40.5N	069.4W	0054	8.1	6.3	1.3	2.5	01/18	7.3	S	16.9	01/07	1021.6
44009	38.5N	074.7W	0734	13.0	12.5	1.0	2.9	28/17	10.1	S	24.3	12/10	1016.8
44011	41.1N	066.6W	0594	8.3	6.9	1.4	3.9	13/05	10.5	SW	22.9	27/17	1015.1
44013	42.4N	070.7W	0735	11.0	9.4	0.6	2.0	30/20	9.0	SW	26.2	12/18	1015.3
44014	36.6N	074.8W	0733	14.4	13.2	1.1	2.6	01/01	9.2	NE	22.5	11/22	1017.5
44025	40.3N	073.2W	0737	11.7	11.1	1.0	2.7	12/13	10.2	SW	29.1	12/12	1016.6
44028	41.4N	071.1W	0736	10.8	10.3	0.8	2.5	12/14	11.3	SW	33.6	12/13	1016.2
45001	48.1N	087.8W	0732	2.9	1.4	0.5	2.6	01/01	7.9	SE	24.9	01/00	1017.0
45002	45.3N	086.4W	0739	4.1	1.9	0.5	1.9	19/13	9.2	NE	27.2	19/12	1016.6
45003	45.3N	082.8W	0737	4.0	1.7	0.5	2.2	01/03	8.0	SW	24.1	01/02	1016.8
45004	47.6N	086.5W	0739	2.6	1.3	0.5	2.4	01/00	7.6	NW	23.3	18/08	1017.8
45005	41.7N	082.4W	0355	12.8	10.4				9.6	NE	21.0	29/15	1013.7
45006	47.3N	089.9W	0721	3.2	1.4	0.5	2.0	01/00	8.0	NE	21.6	10/10	1016.4
45007	42.7N	087.0W	0732	5.0	2.2	0.5	3.5	10/22	8.6	NE	25.8	11/00	1015.1
45008	44.3N	082.4W	0364	5.1	2.3	0.4	1.5	29/09	7.0	NE	19.6	29/06	1015.3
46001	56.3N	148.2W	0736	6.2	6.6	1.6	5.1	23/19	11.1	W	29.5	23/15	1017.7
46002	42.5N	130.3W	0742	11.0	11.8	1.9	5.0	18/13	10.9	N	24.9	18/11	1019.4
46003	51.9N	155.9W	0739	5.5	5.7	1.8	7.2	23/13	9.4	NW	31.5	23/02	1018.2
46005	46.1N	131.0W	0730	9.3	9.8	1.8	4.8	18/22	12.2	NW	26.2	11/10	1019.5
46006	40.9N	137.5W	0737	11.8	12.7	2.0	6.0	18/01	12.9	NE	28.2	17/16	1020.3
46011	34.9N	120.9W	0035	11.4	10.8	2.5	3.0	31/02	18.3	NW	22.0	31/22	1015.4
46012	37.4N	122.7W	0742	11.9	12.0	2.0	4.3	19/17	12.4	NW	27.4	27/09	1015.3
46013	38.2N	123.3W	0736	11.1	10.2	2.1	4.4	27/06	17.0	NW	31.7	28/05	1016.1
46014	39.2N	124.0W	0741	11.3	10.9	2.2	4.6	27/21	15.0	NW	31.1	28/01	1015.9
46022	40.8N	124.5W	0476	11.7	11.7	1.7	4.1	19/05	13.4	N	34.2	17/15	1018.5
46025	33.8N	119.1W	0733	16.3	17.5	1.2	2.5	24/03	7.2	W	28.0	22/00	1013.1
46026	37.8N	122.8W	0739	11.2	11.0	1.8	4.0	27/09	13.8	NW	28.2	27/08	1015.1
46027	41.9N	124.4W	0735	10.4	9.6	1.8	4.7	19/07	13.5	NW	37.7	27/01	1016.6
46028	35.7N	121.9W	0742	12.6	12.8	2.3	4.8	27/18	16.6	NW	27.6	24/01	1016.2
46029	46.3N	124.3W	0696	10.8	12.0	1.6	4.0	18/08	9.8	NW	27.8	17/19	1017.9
46030	40.4N	124.5W	0733	10.7	9.6	2.0	5.0	27/05	14.5	N	31.3	17/16	1018.0
46035	57.0N	177.7W	0728	3.2	3.3	1.5	5.0	08/13	12.8	SE	32.3	05/22	
46041	47.4N	124.5W	0741	13.4	11.5	1.5	3.6	18/03	9.8	NW	30.9	18/02	1017.2
46042	36.8N	122.4W	0737	14.6	11.6	2.1	4.3	27/12	13.5	NW	24.1	23/02	1016.0
46045	33.8N	118.5W	0741	16.7	18.0	1.0	2.5	22/04	6.8	NW	21.4	22/05	1012.9
46050	44.6N	124.5W	0736	11.5	12.5	1.7	4.0	18/08	9.9	N	29.1	17/16	1018.4
46051	34.5N	120.7W	0730	12.2	2.1	4.0		19/10	13.9	NW	24.1	10/01	1014.7
46053	34.2N	119.9W	0734	14.6	14.4	1.2	2.9	22/22	11.5	W	28.0	07/01	1013.0
46054	34.3N	120.5W	0737	13.1	12.6	2.0	4.0	23/11	19.6	NW	32.6	23/00	1014.1
46059	38.0N	130.0W	0736	13.8	15.1	2.0	4.8	18/08					1021.1
46060	60.6N	146.8W	1482	8.2	8.7	0.4	2.1	24/07	6.6	SW	26.4	15/05	1017.1
46061	60.2N	146.8W	1480	7.9	7.9	0.8	3.8	24/08	7.1	SW	29.1	24/09	1017.4
51002	17.2N	157.8W	0741	26.1	26.7	1.8	3.1	01/13	12.1	E	22.1	17/21	1015.2
51003	19.1N	160.8W	0740	25.6	26.7	1.7	3.7	01/09	9.9	NE	18.7	15/20	1016.1
51004	17.4N	152.5W	0734	25.8	1.9	2.9		19/19	11.4	E	21.0	19/19	1016.2
51026	21.4N	156.9W	0735	24.1	24.9	1.5	4.1	01/02					1017.8
91204	9.9N	139.7E	0622	28.2					9.1	E	23.3	10/02	1010.0
91222	18.1N	145.8E	0737	28.4									1011.9
91251	11.4N	162.4E	0739	28.0					14.3	E	25.6	29/19	1010.8
91328	8.6N	149.7E	0738	27.9					6.4	NE	14.0	28/17	1012.3
91338	5.3N	153.7E	0586	27.7					4.2	NE	19.4	07/18	1009.9
91343	7.6N	155.2E	0740	27.7					9.7	NE	22.5	16/00	1009.7
91352	6.2N	160.7E	0741	27.3					8.6	NE	26.2	02/21	1010.6
91355	5.4N	163.0E	0740	27.1					6.1	E	21.4	22/23	1009.3
91377	6.1N	172.1E	0577	27.6					10.2	NE	25.2	19/16	1012.9
91411	8.3N	137.5E	0736	27.6									1009.5
ABAN6	44.3N	075.9W	0741	11.1	6.8				3.9	S	15.3	29/10	1016.6
ALSN6	40.5N	073.8W	0737	13.3	11.1	0.8	2.3	16/22	14.0	S	39.1	12/11	1016.9
BLIA2	60.8N	146.9W	1482	8.3					6.1	NW	38.4	15/04	1013.1
BURL1	28.9N	089.4W	0737	24.5					8.7	SE	18.7	12/14	1018.1
BUSL1	27.9N	090.9W	0638	25.6					7.2	SE	21.4	30/08	1016.1
CARO3	43.3N	124.4W	0736	11.0					10.0	N	27.6	17/22	1018.4
CDRF1	29.1N	083.0W	0738	25.1					8.1	W	21.8	21/05	1017.7
CHLV2	36.9N	075.7W	0736	16.3	15.0	0.8	2.0	28/00	13.6	E	35.3	12/00	1017.8
CLKN7	34.6N	076.5W	0739	20.7					11.5	SW	28.5	30/08	1017.9
DBLN6	42.5N	079.4W	0737	11.3					10.0	SW	30.4	11/00	1016.3
DESW1	47.7N	124.5W	0740	10.1					10.5	NW	43.7	18/03	1017.5
DISW3	47.1N	090.7W	0738	6.6					9.5	NE	28.5	22/01	1017.0

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BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	MAX SIG WAVE HT (DA/HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA/HR)	MEAN PRESS (MB)
DPIA1	30.3N	088.1W	0736	24.8	26.5				9.1	SE	26.2	28/23	1017.6
DRYF1	24.6N	082.9W	0739	26.3					10.2	E	24.1	21/08	1016.5
DSLN7	35.2N	075.3W	0740	19.8	0.9	1.6		31/07	17.5	SW	39.3	12/00	1017.3
DUCN7	36.2N	075.8W	0415	19.2					10.6	NE	22.2	22/05	1016.7
FBIS1	32.7N	079.9W	0736	22.8					9.3	SW	21.5	13/16	1018.1
FFIA2	57.3N	133.6W	0739	10.3					7.2	N	24.5	17/00	1016.8
FWYF1	25.6N	080.1W	0736	26.0	26.7				12.4	E	34.5	21/20	1017.4
GDIL1	29.3N	090.0W	0736	25.1	27.5				8.6	SE	19.5	12/14	1017.1
IOSN3	43.0N	070.6W	0734	11.2					11.8	S	24.8	01/03	1015.0
KTNF1	29.8N	083.6W	0738	24.1					7.8	SW	18.8	12/02	1017.5
LKWF1	26.6N	080.0W	0738	25.4	26.5				9.9	E	25.4	21/21	1017.3
LONF1	24.9N	080.9W	0738	26.4	28.1				11.1	E	23.9	21/17	1017.4
MDRM1	44.0N	068.1W	0732	7.7					13.0	SW	30.7	30/01	1014.7
MISM1	43.8N	068.9W	0740	8.3					13.0	SW	30.5	01/06	1014.9
MLRF1	25.0N	080.4W	0739	26.1	26.8				11.7	E	27.4	21/21	1017.0
NWPO3	44.6N	124.1W	0737	10.6					9.0	NW	28.8	17/19	1017.9
PILM4	48.2N	088.4W	0737	4.2					10.0	E	33.5	18/10	1017.3
POTA2	61.1N	146.7W	1478	8.4					7.4	SW	35.7	15/00	1017.2
PTAC1	39.0N	123.7W	0737	11.0					12.0	N	27.6	17/17	1016.5
PTAT2	27.8N	097.1W	0737	24.7	26.4				15.9	SE	27.1	29/09	1013.2
ROAM4	47.9N	089.3W	0734	5.6	1.6				10.8	NE	41.5	18/09	1016.6
SANF1	24.5N	081.9W	0738	26.2	26.8				11.4	E	24.7	21/19	1016.2
SAUF1	29.9N	081.3W	0737	23.4	24.0				8.6	SE	24.6	31/22	1018.4
SBIO1	41.6N	082.8W	0735	12.6					10.3	NE	30.0	10/17	1016.5
SGNW3	43.8N	087.7W	0700	8.3					11.5	N	30.8	10/11	1017.6
SISW1	48.3N	122.9W	0742	10.0					10.3	W	30.9	18/09	1016.9
SMKF1	24.6N	081.1W	0739	26.5	27.2				12.0	E	28.7	21/09	1017.0
SPGF1	26.7N	079.0W	0739	25.5					6.5	SE	21.1	26/01	1017.9
SRST2	29.7N	094.1W	0738	24.7					14.6	S	31.6	29/23	1015.3
STDM4	47.2N	087.2W	0739	5.6					12.5	SE	32.1	20/07	1018.3
SUPN6	44.5N	075.8W	0739	11.0	7.8				8.4	SW	25.3	29/08	1017.1
SVLS1	32.0N	080.7W	0740	22.8	23.3	0.7	2.0	31/10	11.3	S	25.6	31/11	1017.9
THIN6	44.3N	076.0W	0739	10.8									
TPLM2	38.9N	076.4W	0385	17.5	17.2				9.7	S	27.4	02/00	1014.8
TTIW1	48.4N	124.7W	0741	9.6					10.2	W	28.8	18/05	1017.4
VENF1	27.1N	082.5W	0738	24.8	27.8				7.6	E	22.1	14/21	1017.7
WPOW1	47.7N	122.4W	0734	10.4					8.2	S	22.7	18/02	1017.6
APRIL 1996													
41001	34.7N	072.6W	0719	17.7	20.0	2.2	4.8	02/23	16.7	S	30.9	11/14	1016.1
41002	32.4N	075.3W	0585	20.2	21.3	1.2	2.4	24/12	12.1	S	24.3	16/16	1016.6
41004	32.5N	079.1W	0718	17.6	18.0	1.0	3.5	30/11	11.4	SW	25.8	30/07	1017.0
41006	29.3N	077.3W	0472	20.3	21.6	1.3	3.4	03/03	11.4	S	25.6	16/16	1015.8
41009	28.5N	080.2W	1439	21.2	21.8	0.9	2.1	30/15	11.8	SE	25.5	02/20	1017.5
41010	28.9N	078.5W	1439	21.4	23.0	1.2	3.3	16/18	11.3	S	25.6	16/15	1017.4
41021	31.9N	080.9W	0715	17.1	17.3	0.5	1.6	30/06	10.7	S	27.8	16/10	1016.9
41022	31.9N	080.9W	0718	17.1	17.2	0.5	1.6	30/07	10.7	S	29.5	30/04	1016.7
41023	31.9N	080.9W	0720	17.3	18.0	0.2	0.6	26/19	10.5	S	30.5	30/04	1016.9
42001	25.9N	089.7W	0480	23.4	24.1	1.3	3.1	30/15	14.7	SE	26.8	30/09	1015.9
42002	25.9N	093.6W	0459	22.7	22.9	1.5	3.1	30/10	14.8	SE	31.1	29/19	1014.0
42003	25.9N	085.9W	0716	23.5	26.2	1.2	2.9	16/16	13.6	SE	33.0	15/18	1015.6
42007	30.1N	088.8W	0720	18.1	19.3				12.9	SE	31.5	30/04	1016.6
42019	27.9N	095.0W	0717	20.1	21.1	1.3	3.5	06/06	13.1	SE	30.5	06/12	1014.6
42020	27.0N	096.5W	0714	20.4	1.4	3.9		06/05	13.0	SE	29.9	15/11	1014.2
42035	29.3N	094.4W	0716	18.6	19.2	0.9	2.0	06/03	12.1	SE	28.2	15/12	1014.8
42039	28.8N	086.0W	0717	20.8	20.4	0.9	2.8	16/10	10.3	SE	28.8	29/23	1018.2
42040	29.2N	088.3W	0718	19.2	20.3	1.0	2.7	30/07	11.2	SE	29.1	30/06	1017.5
44004	38.5N	070.7W	0713	11.7	12.1	2.2	6.1	10/15	15.4	W	33.8	10/08	1013.9
44005	42.9N	069.0W	0718	4.7	3.9	1.8	5.1	08/17	15.1	S	34.0	17/01	1010.4
44007	43.5N	070.2W	0716	5.1	4.6	1.1	5.8	17/02	11.2	S	30.7	10/13	1010.2
44009	38.5N	074.7W	0714	8.4	6.6	1.3	3.8	09/23	13.9	S	29.9	24/08	1012.5
44013	42.4N	070.7W	0685	6.2	4.6	1.0	4.2	10/14	11.5	S	24.9	29/23	1010.7
44014	36.6N	074.8W	0712	9.9	7.9	1.4	3.3	02/13	12.9	S	29.0	10/07	1014.5
44025	40.3N	073.2W	0712	6.6	5.0	1.4	3.7	10/06	14.1	S	32.4	10/06	1011.8
44028	41.4N	071.1W	0696	5.0	1.1	3.0		16/21	14.7	SW	33.8	16/15	1011.8
45001	48.1N	087.8W	0148	0.2	0.8	1.3	5.1	26/02	15.3	SW	33.2	26/01	1008.8
45002	45.3N	086.4W	0524	1.9	1.1	0.7	2.2	13/03	12.2	S	28.0	13/02	1009.6
45003	45.3N	082.8W	0498	1.8	0.9	0.9	3.2	26/23	12.3	W	29.9	13/07	1008.9
45004	47.6N	086.5W	0144	-0.1	0.7	1.3	3.6	26/09	15.1	N	29.1	26/12	1008.2
45006	47.3N	089.9W	0049	1.5	0.7	0.8	2.1	30/23	10.6	NE	22.2	30/22	1013.1
45007	42.7N	087.0W	0704	2.5	1.5	0.8	2.9	04/22	11.9	N	24.5	13/20	1011.3
46001	56.3N	148.2W	0718	3.7	4.5	2.7	6.9	05/04	14.3	E	34.6	04/04	999.3
46002	42.5N	130.3W	0717	10.9	11.0	3.3	8.5	16/19	14.8	SE	31.5	16/06	1014.2
46003	51.9N	155.9W	0716	3.4	4.3	3.1	8.4	03/21	12.7	W	35.2	03/16	997.4
46005	46.1N	131.0W	0715	9.1	8.9	3.4	7.6	16/20	16.3	S	33.4	16/17	1010.9
46006	40.9N	137.5W	0716	11.6	12.0	3.8	9.6	16/05	17.6	W	37.9	15/21	1013.3
46012	37.4N	122.7W	0719	12.4	12.6	2.4	5.5	17/06	11.2	NW	27.0	27/23	1018.0
46013	38.2N	123.3W	0716	12.1	12.4	2.6	6.4	17/07	13.0	NW	29.1	27/01	1019.5

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BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	MAX SIG WAVE HT (DA/HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA/HR)	MEAN PRESS (MB)
46014	39.2N	124.0W	0719	11.8	11.9	2.6	5.7	17/08	10.4	NW	28.4	27/23	1018.7
46022	40.8N	124.5W	0717	11.9	12.0	2.7	7.4	17/07	12.2	S	30.9	23/23	1020.1
46023	34.3N	120.7W	0500	13.3	13.7	2.4	5.2	17/14	16.7	NW	32.4	10/20	1017.0
46025	33.8N	119.1W	0714	14.7	14.8	1.3	2.8	13/00	7.4	NW	21.6	13/01	1014.9
46026	37.8N	122.8W	0714	11.8	11.9	2.2	4.6	17/08	10.7	NW	24.5	27/06	1018.2
46027	41.9N	124.4W	0717	11.2	11.9	2.6	6.3	17/04	11.6	SE	32.8	23/18	1017.9
46028	35.7N	121.9W	0717	12.7	12.6	2.6	5.4	17/09	14.2	NW	29.5	26/01	1018.7
46030	40.4N	124.5W	0714	11.4	11.6	2.6	6.4	17/01	13.1	N	31.3	16/03	1019.5
46035	57.0N	177.7W	0714	0.7	1.8	2.3	6.1	09/05	15.2	NE	36.5	09/04	
46041	47.4N	124.5W	0715	11.4	10.6	2.6	6.5	23/23	12.9	SE	32.6	23/23	1014.8
46042	36.8N	122.4W	0716	14.5	12.5	2.5	5.7	17/13	11.7	NW	25.6	01/15	1018.6
46045	33.8N	118.5W	0713	15.2	15.8	1.0	2.5	13/03	6.6	NW	25.5	13/00	1014.8
46050	44.6N	124.5W	0719	11.3	3.0	7.9		23/21	13.4	S	38.7	23/17	1016.7
46051	34.5N	120.7W	0718	12.4	2.5	5.0		17/15	14.1	NW	28.2	25/17	1016.6
46053	34.2N	119.9W	0715	13.5	12.6	1.5	2.7	03/06	11.3	W	30.1	10/22	1015.1
46054	34.3N	120.5W	0710	13.0	12.5	2.4	4.3	28/04	18.4	NW	35.6	10/21	1016.2
46059	38.0N	130.0W	0715	14.0	14.5	3.0	7.8	16/16	11.0	SW	25.1	16/13	1020.4
46060	60.6N	146.8W	1431	4.1	4.8	0.7	2.5	05/16	9.4	E	33.4	05/15	1004.7
46061	60.2N	146.8W	1428	4.3	4.9	1.8	6.4	04/16	13.0	E	34.6	05/14	1004.8
51002	17.2N	157.8W	0720	25.4	26.1	2.4	3.5	10/11	15.1	E	28.9	09/19	1014.9
51003	19.1N	160.8W	0719	24.9	25.6	2.2	3.4	07/10	11.5	NE	23.6	30/10	1016.3
51004	17.4N	152.5W	0716	24.8	25.4	2.4	3.5	15/16	14.1	E	22.6	09/16	1016.5
51026	21.4N	156.9W	0717	23.6	24.1	2.1	3.3	14/20					1018.3
91204	9.9N	139.7E	0503	27.8					9.5	E	21.3	18/01	1009.2
91222	18.1N	145.8E	0135	26.6					4.3	N	11.6	07/03	1011.9
91251	11.4N	162.4E	0712	27.7					16.4	E	23.8	24/00	1009.9
91328	8.6N	149.7E	0720	27.7					7.0	NE	16.5	17/04	1011.2
91338	5.3N	153.7E	0469	27.7					5.1	NE	17.5	05/12	1008.8
91343	7.6N	155.2E	0719	27.7					10.9	NE	24.0	01/23	1008.6
91352	6.2N	160.7E	0716	27.4					9.1	NE	23.6	13/02	1009.5
91355	5.4N	163.0E	0717	27.1					6.4	E	18.6	07/05	1008.1
91377	6.1N	172.1E	0441	27.5					12.3	NE	25.2	06/18	1011.7
91411	8.3N	137.5E	0469	27.9									1008.6
ABAN6	44.3N	075.9W	0719	4.7	2.3				4.6	S	21.8	30/16	1012.4
ALSN6	40.5N	073.8W	0717	8.5	6.2	1.0	3.8	16/11	20.1	S	44.6	16/07	1012.1
BLIA2	60.8N	146.9W	1439	3.5					9.5	N	36.9	05/20	
BURL1	28.9N	089.4W	0717	18.6					12.7	SE	30.8	30/06	1017.7
BUSL1	27.9N	090.9W	0542	20.8					12.4	SE	32.2	29/16	1016.4
CARO3	43.3N	124.4W	0716	10.5					11.5	S	42.6	23/13	1017.6
CDRF1	29.1N	083.0W	0718	19.3					8.4	SW	22.7	15/23	1017.6
CHLV2	36.9N	075.7W	0719	11.9	9.0	0.9	2.3	02/16	18.8	S	39.5	21/02	1014.5
CLKN7	34.6N	076.5W	0717	15.8					12.5	SW	28.6	24/08	1016.0
DBLN6	42.5N	079.4W	0718	4.7					11.8	SW	32.2	21/05	1012.0
DESW1	47.7N	124.5W	0717	9.5					15.3	SE	41.7	24/01	1015.1
DISW3	47.1N	090.7W	0714	1.4					10.8	NE	33.4	26/01	1014.5
DPIA1	30.3N	088.1W	0512	18.5	22.9				12.5	SE	30.5	30/04	1017.1
DRYF1	24.6N	082.9W	0715	23.4					12.5	E	28.0	09/14	1016.7
DSLN7	35.2N	075.3W	0719	15.1	1.2	2.7		02/18	21.9	SW	45.2	02/13	1015.2
FBIS1	32.7N	079.9W	0716	17.2					9.2	SW	24.4	30/09	1016.7
FFIA2	57.3N	133.6W	0720	6.7					11.8	N	30.9	05/02	1007.6
FWYF1	25.6N	080.1W	0715	23.4	24.8				13.7	E	33.0	02/07	1017.5
GDIL1	29.3N	090.0W	0714	19.1	20.9				11.2	SE	29.3	15/10	1017.1
IOSN3	43.0N	070.6W	0715	6.1					15.2	W	38.7	16/23	1010.6
KTNF1	29.8N	083.6W	0716	17.9					8.7	S	34.7	30/04	1017.3
LKWF1	26.6N	080.0W	0503	22.9	24.7				12.1	E	28.8	30/15	1018.1
LONF1	24.9N	080.9W	0715	23.8	25.2				12.5	E	28.5	01/23	1018.6
MDRM1	44.0N	068.1W	0717	4.4					17.9	NW	44.5	17/04	1010.5
MISM1	43.8N	068.9W	0718	4.3					16.8	S	44.4	17/03	1010.9
MLRF1	25.0N	080.4W	0719	23.7	24.7				12.8	E	31.9	02/02	1017.1
NWPO3	44.6N	124.1W	0715	10.5					11.3	S	45.0	23/14	1016.8
PILM4	48.2N	088.4W	0717	-0.3					11.4	N	40.5	25/18	1014.6
POTA2	61.1N	146.7W	1324	3.0					12.8	N	40.5	01/19	1005.6
PTAC1	39.0N	123.7W	0718	11.3					9.6	N	28.4	16/08	1019.3
PTAT2	27.8N	097.1W	0716	19.2					12.9	SE	30.1	26/02	1014.7
ROAM4	47.9N	089.3W	0718						13.3	NE	42.5	25/23	1014.1
SANF1	24.5N	081.9W	0717	23.7	24.6				13.4	E	31.7	01/22	1016.3
SAUF1	29.9N	081.3W	0714	18.3	18.3				8.8	SE	24.5	30/02	1017.9
SBIO1	41.6N	082.8W	0603	7.1					14.5	W	37.6	26/22	1012.2
SISW1	48.3N	122.9W	0715	9.4					11.8	SE	41.8	25/21	1015.3
SMKF1	24.6N	081.1W	0601	24.3	25.0				14.1	E	42.1	01/23	1017.5
SPGF1	26.7N	079.0W	0716	22.8					7.4	SE	24.0	02/07	1018.0
SRST2	29.7N	094.1W	0719	18.3					12.5	SE	29.0	22/06	1015.7
STDM4	47.2N	087.2W	0713	0.1					15.0	NW	40.7	26/12	1014.9
SUPN6	44.5N	075.8W	0551	5.8	3.1				9.7	SW	30.4	30/18	1011.5
SVLS1	32.0N	080.7W	0717	16.8	16.7	0.6	2.2	30/09	12.2	S	33.7	16/13	1016.9
THIN6	44.3N	076.0W	0714	4.6									
TPLM2	38.9N	076.4W	0536	10.0	8.8				13.1	S	30.2	16/03	1013.4
TTIW1	48.4N	124.7W	0719	9.1					13.4	E	50.1	24/00	1014.9
VENF1	27.1N	082.5W	0720	20.3	22.6				8.7	E	27.3	02/06	1017.9
WPOW1	47.7N	122.4W	0715	10.0					10.7	S	27.6	23/21	1016.4

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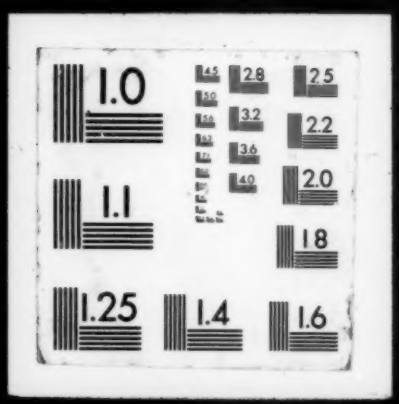
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